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**ANNUAL REPORT OF THE**  
**U. S. ISTHMIAN CANAL**  
**COMMISSION, 1905-1914**

**FOR THE FISCAL YEAR ENDING JUNE 30**

**1911**



**WASHINGTON**  
**1911**



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ANNUAL REPORT  
OF THE  
ISTHMIAN CANAL COMMISSION.

ISTHMIAN CANAL COMMISSION,  
OFFICE OF THE CHAIRMAN,  
*Culebra, Canal Zone, September 1, 1911.*

SIR: I have the honor to submit the annual report for the Isthmian Canal Commission for the fiscal year ended June 30, 1911.

ORGANIZATION.

At the time of the issue of the Executive order of January 6, 1908, creating various departments, among them that of law, the legal department was established in Washington. This office ceased to exist on April 30, 1909, upon the resignation of the then general counsel, after which date legal matters affecting contracts were handled by the assistant examiner of accounts. Certain legal matters on the Isthmus were, by Executive order of April 10, 1910, placed in charge of the counsel and chief attorney of the commission, the Executive order also fixing his duties. The status of the canal construction is such as to render necessary the adoption of measures for adjusting the unsettled land titles as soon as practicable. These duties devolved upon the former general counsel, and it was deemed necessary in the interests of the work to have these duties, as well as all legal matters on the Isthmus, under one head. To this end, with the approval of the Secretary of War, the department of law was established on the Isthmus and placed under the counsel and chief attorney of the commission.

In furtherance of this same policy a land office for the Canal Zone was created by Executive order on January 19, 1911, in which are to be kept all maps, records, papers, and other documents relating to lands owned or controlled by the United States in the Canal Zone, and to lands auxiliary to the canal in the Republic of Panama outside of the Canal Zone. This accomplished the consolidation of the present land offices of the commission and the Panama Railroad Co., providing a more prompt and economical handling of Government land matters. The expenses of the land office are shared between the



commission and the Panama Railroad Co. in accordance with an agreement entered into by the two interests.

With the exceptions noted the organization of the forces on the Isthmus has continued practically as outlined in previous annual reports.

#### CONSTRUCTION AND ENGINEERING.

The first division of the office of the chief engineer, under Col. H. F. Hodges, United States Army, assistant chief engineer, continued in charge of the design of the locks, dams, regulating works, and accessories. The scope of the division was increased so as to add to these duties the design and construction of aids to navigation, the inspection of the manufacture and erection under contract or otherwise of the lock gates, operating machinery, gates and valves, emergency dams, and of the placing of such concrete in the locks as must be omitted until the machinery is installed.

During the year the general plans of all the locks were practically completed, and such detailed drawings as were required by the field forces were prepared and issued. The designs for the approach walls at all locks, with the exception of the south middle approach wall for Miraflores, have been prepared.

The contracts which were in force at the beginning of the year for valves, frames, and bulkheads were practically completed. During the fiscal year new contracts were entered into, or advertisements issued, for the remaining frames, valves of all description, snubbing hooks, spillway gates, spillway bridges, and all fixed steel required for the completed locks. In addition, 954 tons of castings for structural material were made at the commission shops at Gorgona.

With a view of ascertaining the friction coefficient and leakage under working conditions, a series of tests of the rising stem or Stoney valves were undertaken at Gatun under the supervision of this division. From the first test, a coefficient of static friction at initial movement of 0.198 and rolling friction of 0.147 was obtained. The tests for determining this coefficient and leakage under working conditions are now being made. One of the cylindrical valves was tested for leakage at Pedro Miguel under a head of 65 feet on the valve seat. The leakage under this head was found by measurement to be 0.128 cubic feet per second, or about 1.3 cubic feet per second for the 10 valves in each lock.

During the year, all the material under the contract for the fixed parts pertaining to the miter lock gates was delivered. Work has been in progress under the contract entered into June 21, 1910, for the construction of the gate leaves proper, and the shops had completed on June 30, 1911, ready for shipment, practically all the material for the eight leaves 54 feet 8 inches in height, comprising the upper

guard gates in Gatun and Pedro Miguel locks; eight leaves 77 feet high for the upper and middle gates in the upper lock at Gatun were nearly completed, while eight more leaves 77 feet high for the safety and lower gates in the same lock were about half done. Shipments from the shops aggregated about 7,000 tons. The output of the shops has reached about 900 tons per week, or nearly one and one-half leaves.

Under the contract, the erection of the gates was to begin on January 1, 1911, at Gatun, and on March 1, 1911, at Pedro Miguel. Although the contractor's erection plant was practically ready on the dates mentioned, actual erection was not begun until later due to delays in delivering the material. They commenced attaching the nickel steel bearing plates to the castings in the hollow quoins at Gatun on March 21, 1911, and placed the bottom girders for the four upper leaves in the upper guard gates on May 17 and 19. By the end of the fiscal year the skeletons of these four leaves were in position for a height of four panels and those on the east chamber completely riveted. No permanent work had been done at Pedro Miguel.

Fender chains are to be placed about 500 feet above and 230 feet below the upper and lower guard gates, respectively, in the locks at Gatun, Pedro Miguel, and Miraflores, and also at points 80 feet and 100 feet, respectively, above the hollow quoins of the middle and safety gates in the Pedro Miguel lock, and in the upper chambers at Gatun and Miraflores. When not in use, these chains will rest in grooves in the floor and side walls of the locks. When in use, they will be raised to the surface of the water, forming a barrier to the passage of ships. The chain is arranged in such manner as to pay out against a resistance when struck by a vessel, and the strength of the chain and the intensity of the resistance are so calculated that the energy of a ship of 10,000 tons' displacement moving at the rate of about 4 miles an hour will be absorbed after striking the chain and before reaching the gate. During the year, the study of the device had made sufficient progress to determine the type of the first sample machine to be bought. The resistance will be provided by hydraulic cylinders at each end of the chain, the liquid from the cylinders being forced to circulate through a resistance valve, which will function only when a strain of about 100 gross tons comes upon the chain. Trial with the sample chain will determine the character of the remainder to be installed.

To permit examining, cleaning, painting, and repairing the lower guard gates, and for access in the dry to the sills of the emergency dams, it is proposed to provide floating caisson gates, and a design of the molded ship type has been prepared. An alternative design of the type now used for dry docks in the United States is under consideration; this may give less cost by eliminating largely the use of curved

frames and plating. The caissons will be equipped with electric motor-driven pumps for use in pumping out the caissons and for unwatering the locks.

The bids received in response to invitation, as noted in the last annual report, for operating machinery for a certain number of valves were not satisfactory and they were rejected. New bids were issued and a contract made providing for the purchase of two machines of each type for trial, with the option of buying all that will be needed for the entire canal; in this case the installation is to be done by the commission forces. Motors and limit switches for the two machines were purchased from various companies with a view to thoroughly testing their ability to stand the trying conditions of the climate before ordering the electrical parts for the entire canal. Bids were also invited for the purchase of the machines for operating and locking the gates, the purchase of two machines being guaranteed, with the option of securing the remainder if the tests of the samples prove satisfactory.

The plans for the emergency or movable dams were completed in the early part of December, 1910, and work of constructing and erecting them in place was advertised on January 14, 1911. The contract was awarded to the United States Steel Products Co. for the sum of \$2,238,988.40, the lowest bidder. The time pledged for completing the erection of the dams is as follows: At Gatun, August 15, 1912; at Pedro Miguel, January 15, 1913; and at Miraflores, June 15, 1913. The machinery for raising and lowering the wicket girders of the emergency dams and the gates which close the openings between these girders has been designed and is included in the above-mentioned contract.

Study has been given to the electrical system which will be used for the operation of the canal after completion. This contemplates a hydroelectric station on the Gatun Dam with a reserve generating station at Miraflores to be operated by steam. The two stations are to be connected by a transmission line, and current from either, or both, can be used for any of the operations of the canal. Specifications for the equipment of the hydroelectric plant are ready for issue.

The detailed drawings for the Gatun spillway and the general plan of the Miraflores spillway, with the necessary detailed drawings, have been completed, as well as drawings for the steel footbridge to span the gate openings at both spillways, and for the caissons which will be used to replace any defective gate and permit repairs to be made to the latter in the dry.

The scheme for lighting the canal has been prepared and adopted. It contemplates the use of range lights for establishing the direction on the longer tangents, and of side lights spaced about a mile apart to mark each side of the channel. A light and fog signal is located on

the west breakwater in Limon Bay, and gas and nun buoys will be placed to mark the channel to the Mount Hope dry dock. Three types of lighted beacons will be used and are to be built of reenforced concrete. The project contemplates the construction of 34 tower beacons, 57 beacons, 57 gas buoys, 76 spar buoys, and 7 nun buoys. Reference targets for marking the ranges where lights are not used and for fixing the location of the gas buoys will also be erected. The sailing lines marked by the range lights, except at the entrances to the canal, will be so placed that all ships will follow a course 125 feet to their starboard of the axis of the canal; thus two passing ships, if on their ranges, will have their center line 250 feet apart. For locating and referencing the gas buoys, and for providing an unrestricted view of the range and reference targets, 1,000 acres of land must be cleared. Work was begun on April 20, and at the close of the fiscal year 375.5 acres had been cleared, 148,000 feet of trochas cut, and 16,000 lineal feet of profile taken.

In the report of the Isthmian Canal Commission for 1899-1901, Mr. S. H. Woodard discussed the effect upon the lock gates of the difference in densities between the water on the two sides of the gates of the lowest locks. In the course of the design of the lower portion of the lock flights at Gatun and Miraflores, it appeared that the pressures might prevent the opening of the gates, or even under possible conditions bring such pressure on the downstream side as would expose the operating apparatus to reverse stresses. Further, the rise and fall of tide, especially at the lock leading to the Pacific, might occasion trouble at the lower gates if combined with carelessness on the part of the operating force. Thus, if the pair of lower operating gates and the pair of lower guard gates should be both shut, with the lower lock filled, on a rising tide the water outside the lower guard gates might rise, leaving the water in the space between the lower operating and guard gates at a lower level than either the water in the lock or the water outside, thus interposing difficulty in the operation of the guard gates; or, were the lower gates of the lock to be shut and the guard gates open, with the lock itself at its low level, on a rising tide reverse pressure would be produced on the operating mechanism of the lower gates. These questions were considered by a board appointed for the purpose, and as the result of study and experiment the board reported that it is possible to find for a given condition of density, depth of water, and location of culvert, an elevation for the outlets of the culverts at which there will be no resultant unbalanced pressure on the gate leaves due to difference in density of water on the two sides after flow through the culvert has ceased. Applying the analysis to known conditions at the lower gates at Gatun and Miraflores, the board determined positions for the outlets of the culverts and recommended that they be placed at these

elevations in the horizontal plane of the roof of the culvert, thus directing the flow of the water upward. It also recommended the placing of valves in the lower guard gates to provide against pressures due to tidal action. As a result, a design for the outlet of the culverts in the lower locks has been adopted, which it is believed will obviate any serious trouble.

For further details concerning the matters handled by the first division of the chief engineer's office, attention is invited to Appendix A.

#### ATLANTIC DIVISION.

The work in this division embraces the construction of the locks and dam at Gatun, the quarry at Porto Bello, the sand supply at Nombre de Dios, the excavation between the locks and deep water in the Caribbean, the breakwater for the shelter of shipping and protection of the channel in Limon Bay, municipal improvements in Colon and various settlements embraced within the territorial limits of the division, and such sanitary engineering construction within the same limits as is prescribed by the sanitary department. The work is in charge of Lieut. Col. William L. Sibert, United States Army, as division engineer.

*Gatun locks.*—At the close of the previous fiscal year the excavation was completed, with the exception of part of the trenching required for the lateral culverts in the intermediate locks, and it was then reported that 375,000 cubic yards remained in the lower lock site. During the fiscal year just ended the excavation of the lower lock was practically completed to include the location of the caisson sills. A total of 475,875 cubic yards were removed by steam shovels, at a cost of \$0.7110 per cubic yard. The original estimated amount was increased by reason of slides in the lower lock, especially on the east side, and at the north end of the east side wall it was necessary to go to a depth of 66 feet below sea level in order to secure a suitable foundation. The excavation to the north of the caisson sills will be done by dredges, and to prevent the water from flooding the lock while this excavation is in progress a concrete dam 50 feet in height is projected, at an estimated cost of \$30,000 for its construction and removal. In the preparation of the foundations for the locks there were removed by shovel, crane, and hand 152,582 cubic yards, at a cost of \$1.5540 per cubic yard.

The construction plant was modified by changing the automatic railroad from the third-rail system to a trolley system, resulting in a more satisfactory service. The sand bin, which the last annual report noted as constructed north of the cement shed and arranged so as to feed into the automatic cars, was taken down and rebuilt farther to the north on the same level with the stone bins previously erected.

The derricks which had been used for unloading at Mindi were moved about January 1 to the vicinity of the cement shed, where they have been working two shifts per day unloading sand. The erection of an additional derrick, making five derricks all told, and a rock screen was completed in February, and used for supplying screened stone for reenforced concrete work and for making concrete piles. The auxiliary plant was continued in use at its original location, but part of the narrow-gauge equipment, which formerly operated in connection therewith, was employed in carrying concrete supplied by the permanent plant through chutes to the places in the floors and walls where the concrete was required.

During the year the unloading cables were operated for 24 hours per day, except Sundays, and handled 500,550 cubic yards of crushed stone and 241,858 cubic yards of sand. Operating on the basis of 24 hours per day, 49.43 per cent of the time was consumed in unloading operations; the balance lost in waiting for barges, 24.21 per cent; and in other delays, 26.36 per cent. These cableways averaged, therefore, 21.14 cubic yards per hour while in service, or 42.77 cubic yards per hour in actual working time of unloading. The quantity of material handled during the year by an average of 3.93 derricks, operated on an average of 19.12 hours per day, was 294,665 cubic yards of crushed stone and 166,606 cubic yards of sand, a total of 461,271 cubic yards of material. This material was unloaded by these derricks at an average rate of 20.08 cubic yards of material per hour while in service, and 40.91 cubic yards per hour in actual working time of unloading. The operating cost of handling material by cableways and derricks, exclusive of plant charges, was \$0.2290 and \$0.2044 per cubic yard, respectively. The major portion of the material unloaded by derricks was used at the auxiliary plant and transported by rail at a further cost of \$0.1766 per cubic yard. The derrick and rock screen furnished 2,003 cubic yards of material, at a cost of \$2.9059 per cubic yard. The costs given in all cases include plant charges and division expenses, except when noted to the contrary.

During the year 945,525 barrels of cement were received into the storehouse; in May, 1911, a change was made in the container, bags being substituted for barrels. During the year an average of 6.08 of the eight 2-yard mixers installed in the construction plant furnished a total of 602,851 cubic yards of concrete, bucket measurement, and were operated daily except Sundays on the basis of 12 hours per day, or at the rate of 26.56 cubic yards per mixer per hour. The auxiliary plant mixers, two in number, operated on an average of 9 hours a day, except between September 21 and November 5, 1910, when they were operated on a 12-hour basis, and mixed 226,476 cubic yards, bucket measurement, or an average of 40.63 cubic yards per

hour per mixer. Four one-half-yard mixers were purchased and, together with a small amount mixed by hand, produced a total of 10,175 cubic yards.

The product of the construction plant mixers was placed by cableways or transferred by chutes to narrow-gauge equipment, from which the concrete was dumped in place. The cableways were operated 12 hours per day; 64.16 per cent of this time was consumed in handling 616,661 cubic yards of concrete and large rock, 8.80 per cent in handling forms and iron, and 27.04 per cent in delays. Each cableway handled an average of 32.45 cubic yards of rock and concrete per hour when engaged on that work. The narrow-gauge equipment handled 286,265 cubic yards of concrete and large stone. The total amount of masonry (concrete and large stone) laid by the construction plant, auxiliary plant, portable mixers, and by hand aggregated 911,137 cubic yards, or at a rate of 260.573 cubic yards per hour in service. The cost of the masonry was \$6.6446 per cubic yard. The stone laid in the concrete was selected from material taken to Gatun from the Culebra Cut and was delivered on the banks at a cost of \$1.3366 per cubic yard. On the basis of the estimated amount of concrete required in the Gatun Locks, namely, 2,085,000 cubic yards, the masonry work at the close of the year was 68.34 per cent completed.

The backfilling in the rear of the side walls of all the locks was partially placed during the year, that for the east side of the upper lock being completed sufficiently to form a storage yard required by the gate contractor. Backfilling to the amount of 535,669 cubic yards was accomplished during the year, at a cost of \$0.5307 per cubic yard; 2,717 cubic yards of filling were placed in center wall, at a cost of \$1.0634. The ground adjacent to the lower locks is lower than the walls and slopes toward the north so as to necessitate trestles for carrying the cableway tracks; these have been built and will be utilized in making the fill in rear of the lock walls. To protect the lock pit against the material sliding into it a toe wall was constructed along the east side and backfilled.

Arrangements were made for the construction of concrete piles which are to form the foundations for the upper or south middle approach wall. They are to be driven into the fill which was partially completed at the beginning of the fiscal year, extending out to the intersection of the center line of the locks with the old east diversion channel; during the year this fill was completed. A total of 31,060 feet of piling was constructed of improvised reinforcement and 8,196 feet driven. The cost amounted to \$2.2120 per lineal foot. Sand for this work was obtained from the Pacific division. Owing to the difficulties experienced with the longer piles, the substitution of creosoted for concrete piling is under consideration.

*Stone and sand.*—Crushed stone for the concrete of the locks and spillway was obtained from the Porto Bello quarry. The single face which had been developed during the previous fiscal year was increased, with the result that its length was 2,600 feet and maximum height 170 feet. Shortly after the plant was placed in operation, March 2, 1909, it was manifest that the largest crushers, No. 9, could not economically perform the work because of the difficulty and expense in reducing the stone to proper size for these crushers. As a remedy, a No. 21 crusher was ordered in November, 1909; it was installed and put into operation on September 4, 1910. Difficulties experienced with the pan conveyors were remedied after they were remodeled and laid on heavier tracks. The larger crusher receives stone of the maximum size handled by the steam shovels, so that as long as it is in operation "dobey" blasting at the crusher is dispensed with. The changes made result in increasing the capacity of the plant and reducing the cost of production. The total amount of stone crushed during the year was 864,033 cubic yards, at an average cost of \$1.3862. The output of the crushers averaged 253.23 cubic yards per hour in service, and 348.51 cubic yards per hour crushing. Up to September 17, the quarry was operated on the basis of two shifts, or 16 hours per day, on which date a 12-hour day was adopted and continued until January 16, when the working day was reduced to 10 hours, and on February 15 the normal working day of 8 hours was adopted. The material was transported to Gatun in barges, whence it was transferred to the stock piles; the cost per cubic yard delivered in the stock piles at Gatun amounted to \$2.3403 per cubic yard. The Porto Bello quarry is also to supply rock needed for the outer stone or armor of the breakwater at Toro Point. The necessary plant for this purpose has been ordered and a wharf at Porto Bello is under construction.

Sand was obtained from Nombre de Dios by means of two cranes and three dredges, and from the Pacific division. At Nombre de Dios the sand was procured from the channel and from the area occupied by the buildings which were destroyed by the fire of April 8, 1910. These buildings were replaced in the rear of the town at a cost of \$9,555.05. The cranes and rolling stock were removed in May. The total amount of sand obtained was 441,919 cubic yards, which was transported in barges to Gatun, whence it was transferred to the stock piles. The cost per cubic yard in the stock piles was \$1.8565. The Pacific division furnished 17,319 cubic yards of sand, at a cost of \$1.1733 per cubic yard.

For the transportation of sand, stone, and cement 4 tugs, with the occasional service of a fifth, 1 stern-wheel towboat, and 18 barges have been in use; 4 additional barges, purchased under contract, were received during the year.



*Gatun Dam.*—At the beginning of the year the north and south dry fills of the east portion of the dam, extending from the locks to the spillway, had reached an elevation of 65 feet above mean tide, and the hydraulic or impervious portion between them had been carried to an elevation of 51 feet. At the close of the year the dry fills were raised to an elevation of 85 feet and the hydraulic fill to +73. On July 1, 1910, the north and south dry fills of the portion on the west side of the spillway were at elevations 30 and 35 feet, respectively, and the intermediate hydraulic material was at +16; sufficient material was added during the year to make these elevations at the close of the year +60, +67, and +57.3, respectively. In securing this increase in the elevation of the earth portion of the dam the cross sections show that 2,060,186 cubic yards of dry material were placed in the structure; also, that the dredges delivered into the interior portion of the dam some 3,758,870 cubic yards of material. In other words, there was a total increase during the year of 5,819,056 cubic yards by cross-section measurements.

The amounts of material noted as resulting from the cross-section measurements of June 30, 1910, and June 30, 1911, differ from the aggregate of the amounts reported monthly as having been placed in the dam, and on which the unit costs are computed, by 1,109,619 cubic yards. Cross sections were made each month of those portions of the dam on which work was in progress with a view to securing the net yardage, but in comparison with the annual survey a shortage of 612,096 cubic yards in the dry fill and 497,523 cubic yards in the wet fill is shown. In constructing the dam the dry fill is thrown toward the center, thus causing the material to rest on or sink into the hydraulic fill, depending upon the solidity and bearing power of the latter. This, together with consolidation that is in progress, due not only to the natural settlement but also to the constant passage of heavy trains over the mass, makes it impossible for purposes of cross sectioning to determine the line of demarcation between the dry fill and the wet. Also, by the method of construction, the hydraulic material is crowded toward the center as the dry fill progresses, thereby raising the liquid mass and creating a greater head at the drainage pipes, causing the escape of more of the wet fill than would otherwise result, in addition to which the hydraulic material is forced into the voids in the dry fill, making it impossible of accurate measurement, though at the same time making it a more compact and therefore tighter structure. A record of the amount of settlement in the dam was started, and for this purpose hubs were driven over the slopes of the dam about 250 feet apart, parallel to and about 100 feet apart at right angles to the axis. The elevations of these hubs are taken monthly and platted. Based on the monthly reports of materials placed in the dam, the cost for the year averaged \$0.3813 per

cubic yard for dry fill and \$0.2289 per cubic yard for wet fill. The increase between these costs and those that necessarily result from the decrease in quantities shown by the cross sections will be accounted for in determining the final cost of the work.

A new trestle was built across the spillway channel at elevation 45 to give easier access to the dry fill of the west portion of the dam, and also to replace the old one which was in bad condition. To handle expeditiously and economically the increased supply of material from the Culebra Cut which was permitted by the additional number of cars purchased under contract, an extension of the track system was made so that at the close of the year there were 21 miles of tracks connected with the construction of the dam and auxiliary works.

Material for the dry fill was obtained from the Culebra Cut, from the lock site, from Mindi, from the spillway, and from a borrow pit below or north of the dam; based on car measurements the quantities from each locality amounted to 2,065,272, 320,599, 8,179, and 332,044 cubic yards, respectively. The service from Culebra was interrupted for one week during the December flood.

The hydraulic fill was obtained from above and below the dam and placed by five suction dredges, three of them operating practically throughout the year, one operating for four months and the other for a little over two months. From September 16 to November 11 hydraulic filling of the east section was suspended to enable the concentration of the available dredges on the west portion of the dam, so as to bring the fill up to +30 before the flood periods, and to permit a drying out of the east part of the dam. From January 1 to April 15, pumping into the east portion was discontinued in order to determine to what extent the hydraulic fill would dry out and solidify. The tests showed a greater solidity on the north side of the fill and when operations were resumed more of the sandy material was pumped along the opposite side. While a gradual solidification took place during the dry season, the central portion showed but little change, and unless this soft material is crowded out during the subsequent construction, or hardened by addition of more sandy material, part of the fill must be drained off after the full height is reached.

In addition to the maintenance of the tracks, miscellaneous work consisted of installation of pipes, including trestles therefor from the dredges to the relays, of which four were in operation, and from the relays to various points along the length of the dam for the delivery of the hydraulic fill; laying pipes for draining water and finer material from the fills; stripping and spading up subsoil in advance of the hydraulic fill; and clearing ahead of the dredges.

Based on the estimated amount of material needed in the construction of the dam, it is 74 per cent completed.

In the construction of the spillway work was confined to the excavation necessary for the east and west approach walls and in the forebay. During the year the concrete work on the forebay below reference 45 was completed, and the approach walls with projections or cores to tie the earth portion of the dam with the spillway were completed to elevation 95 for the straight horizontal portions and the slopes to the south. During the dry season, after the discharge from the lake had sufficiently diminished, construction and sluicing piers were begun and carried up to 45 feet above sea level; the balanced valve and three sluice gate frames were set; cofferdams were built on both sides of the channel below the spillway dam, and the foundations were prepared and concrete placed so as to build sufficient of the ogee of the dam to bring it above high water. Subsequently two additional small cofferdams were constructed for placing concrete of the dam just outside of the channel flow. After the beginning of the wet season the construction of the side sections of the dam and of the side approach walls was continued. There were excavated during the year 125,383 cubic yards, at a cost of \$0.4069 per cubic yard, practically completing this part of the work. In preparing foundations 32,245 cubic yards of material were removed, at a cost of \$1.5048 per cubic yard. Concrete placed during the year amounted to 59,651 cubic yards, at an average cost of \$6.7044 per cubic yard. The concrete portion is 66 per cent completed. Tracks were laid and back fill begun behind the side walls of the channel below the dam. The total back fill at the spillway during the year aggregated 12,873 cubic yards, at a cost of \$0.4832 per cubic yard.

The levee connecting Spillway Hill with Mindi Hill was completed in accordance with the approved plan. To accomplish this, 51,156 cubic yards of dry fill were placed, at a cost of \$0.1979 per cubic yard, and one of the suction dredges placed 20,398 cubic yards of hydraulic fill in the old Chagres River bed east of the levee, at a cost of \$0.1631.

*Channel between Gatun Locks and Atlantic Ocean.*—To the north of the locks and between them and Mindi Hills one of the 20-inch suction dredges removed 423,427 cubic yards from the canal prism, pumping the material into swamp areas to the east.

The excavation through the Mindi Hills was flooded, as noted in the last annual report, and no work was done until October, 1910, when a suction dredge began to cut a way from the French canal into the cut through the barrier which had been left to exclude the water so that the excavation could be done by steam shovels. The soft material that had been deposited by the floods and the clay moved into the cut by the slides was removed by a hydraulic dredge

and deposited in the swamps to the east of the canal line; the total amount of material handled was 401,511 cubic yards. After the removal of the dredge in January the opening in the barrier was closed and the cut freed from water by pumping. Steam-shovel work was resumed on February 1 and carried on throughout the balance of the year, removing 53,199 cubic yards of earth and 227,106 cubic yards of rock, at an average cost of \$0.6010 per cubic yard. Of the material excavated, 165,000 cubic yards of rock were used for back fill behind the lock walls; the balance was utilized in filling a trestle which had been constructed just east of the Panama Railroad relocation between Mindi and New Gatun, thereby forming a levee behind which it is proposed to pump material that will be excavated between the Gatun Locks and Mindi by means of suction dredges. In the construction of this levee 5,650 lineal feet of trestle were built and filled. In addition to the material obtained from excavation at Mindi, part of the material removed from the lock pits was utilized.

The dredges which operated between the Mindi Hills and deep water in the Caribbean in excavating the canal prism were the sea-going dredge *Caribbean*; the 5-yard dipper dredges *Chagres* and *Mindi*; and three French ladder dredges. These dredges removed 4,516,369 cubic yards of earth and 487,038 cubic yards of rock, at a cost of \$0.2215 per cubic yard, cost including plant charges and division expenses. The amount of silt deposited in the channel during the year was about 2,750,000 cubic yards; in the first 2 miles of the channel surveys in June, 1910, and June, 1911, showed a silting of 310,901 cubic yards; in mile 3 the silting was 902,038 cubic yards; surveys made immediately after the norther of December 3 to 5, inclusive, showed a fill of about 370,000 cubic yards.

In addition to the dredging in the prism, 442,350 cubic yards of earth and 4,853 cubic yards of rock were removed from the channel in front of Piers 11 to 14, inclusive. Miscellaneous dredging in the vicinity of the dry-dock slip, Shelter Cove, in the French canal, and in front of the cement dock at Gatun, aggregated 51,636 cubic yards of earth and 18,886 cubic yards of rock.

At the dry-dock shops the boiler-shop extension was completed, the necessary jib and traveling cranes erected, a condenser installed, and an oil forge added. These shops maintain the fleet of dredges, barges, and tugs in charge of the Atlantic division in working condition.

*Breakwater.*—Preparations were made so that active operations in the construction of the breakwater leading out from Toro Point could be undertaken at the beginning of the fiscal year. The necessary buildings were constructed, machines installed in the shop erected for repair work, and construction material collected and

stored. A reservoir was constructed for the water supply, necessitating the building of dams which contain 54,390 cubic yards of material, and the necessary pipe lines were laid. A trestle for the breakwater was started on August 9, 1910. A steam shovel began work early in September, and a second one in October. At the end of the year 5,365 lineal feet of double-track trestle had been completed, and 859,890 cubic yards of fill dumped from the trestle. In addition, 619,152 cubic yards of rock dredged from the prism were dumped in the vicinity of the breakwater. The average cost of the fill was \$1.4506 per cubic yard.

*Municipal improvements.*—A rapid gravity mechanical filter plant was authorized for the Agua Clara Reservoir in January at an estimated cost of \$37,447. At the close of the year 94 per cent of the concrete work was completed, and the filter plant as a whole, including the installation of piping and filter apparatus, was 80 per cent completed.

Sewers were extended a total of 4,425 feet, and the usual maintenance work in connection with the sewage system was carried on throughout the year.

A 16-foot macadam road was built from the incinerator to New Gatun, a distance of 1,400 feet; a 12-foot road, 650 feet long, was constructed from the corral to the lumber yard for fire protection, and 101 feet of the road entering the corral were rebuilt. About 3,100 feet of curb and gutter were constructed along the streets in Gatun. In addition municipal improvements were carried on in Colon under an appropriation by Congress for the purpose.

Sanitary work consisted of cleaning and grading 197,834 feet of ditches and cleaning 29,160 feet of road ditches.

For further details attention is invited to Appendix B.

#### CENTRAL DIVISION.

The work of this division embraces all the excavation between the Gatun Dam and Pedro Miguel Locks, including diversion channels; the construction of the Naos Island breakwater, clearing of timber from the channel and anchorage basin, municipal improvements in the various settlements included within the division limits, and such sanitary engineering work in the same area as is prescribed by the sanitary department. The work is in charge of Lieut. Col. D. D. Gaillard, United States Army, as division engineer.

The division is divided into four construction districts—the Chagres district, extending from the Gatun Dam to the Chagres River at Gamboa; the Empire district, extending from the Chagres River to the Empire Suspension Bridge; the Culebra district, from the Empire Suspension Bridge to the railroad crossing north of Pedro

Miguel Locks; and the Pedro Miguel district, embracing the excavation between the railroad crossing and the locks, the dumps south of Pedro Miguel, and the construction of the Naos Island breakwater. The Culebra Cut proper extends from Gamboa to Pedro Miguel.

*Chagres district.*—Below Gamboa the Chagres River crosses the axis of the canal 23 times before reaching Gatun, forming a series of peninsulas, which, beginning at Gamboa, are known as Point 1, Point 2, Point 3, etc. The material which remained to be removed July 1, 1911, in Point 1, consisted of gravel and sand washed in by the Chagres River. During the year 20,455 cubic yards of gravel were removed and taken to the storage piles; it is used for track ballast and concrete. About 90,000 cubic yards remained on July 1, 1911, and though part of this will be removed for ballast, the full depth over this area will be secured by suction dredges after the lake is raised.

Point 2 lies between Matachin and Gorgona, and gravel and sand were removed to the amount of 46,102 cubic yards, leaving at the end of the year about 5,000 cubic yards of silt.

Point 3 lies on the east side of the Chagres River opposite Gorgona. At the close of the previous fiscal year the removal of 157,522 cubic yards was necessary to complete the section; this was loosened by blasting and 16,254 cubic yards removed; as the amount remaining had been reduced to 50,000 cubic yards on June 30, 1911, 91,278 cubic yards were washed away by the freshets.

Point 4 lies on the left bank of the Chagres River at Gorgona, and 828,462 cubic yards of material were removed by steam shovels, leaving 1,000 cubic yards to be removed by dredges.

Point 5 is at Juan Grande, and 438,241 cubic yards of material were removed during the fiscal year, completing this section.

Point 6 is north of Juan Grande. This section was completed in October, 1910, by which time 112,238 cubic yards of material had been removed by steam shovels.

At East Mamei 598,213 cubic yards of material were removed by steam shovels during the year, and the work at this point was completed in March, 1911.

At Mamei 10,086 cubic yards were removed by steam shovels in July, 1910, completing the work on the 21st of that month.

At Tabernilla 51,970 cubic yards of material were removed in February and March, 1911, 50,917 cubic yards of which were handled by steam shovels and the balance by hand and orange-peel cranes.

At Caimito 731 cubic yards were removed by steam shovels in March, 1911, completing the work at this point.

Of the contracts reported as in force at the close of the previous fiscal year, that between San Pablo and Bohio was completed by the removal of 13,832 cubic yards during the year, making the total amount removed from this section 170,808 cubic yards.

The contract entered into under date of March 21, 1910, for the removal of 202,140 cubic yards from the canal prism between Tabernilla and Bohio is still in progress, the contractor removing 105,532 cubic yards during the year.

A contract was entered into on December 6, 1910, for excavating about 112,450 cubic yards from the canal prism between stations 28-1000 and 28-2300. Work was begun in December, 1910, and by the close of the fiscal year 58,904 cubic yards had been removed.

The total amount removed from the Chagres section during the year aggregated 2,301,020 cubic yards, leaving on July 1, 1911, to complete this portion 533,921 cubic yards; of this amount 257,959 cubic yards are at San Pablo, and 15,100 cubic yards at Tabernilla. Work at neither place is possible until the new line of the Panama Railroad is placed in operation, and as this will be done by January of the next fiscal year, it is expected that these portions of the canal prism will be excavated to full depth during the coming dry season. With the exception of the contracts heretofore noted as still uncompleted, the balance of the excavation will be completed by suction dredges after the lake level is raised.

The excavation in the Chagres River section was 95.68 per cent completed on June 30, 1911.

The work of clearing, grubbing, and burning trees in the channel of Gatun Lake by hired labor was commenced at the beginning of the dry season, and 182 acres of trees and brush were cut in the vicinity of Chagrecito and Bohio at a cost of \$21.9329 per acre. This completes all clearing of channel throughout the central division.

In connection with lighting and buoying the canal, this division cleared 373.5 acres at a cost of \$24.4469 per acre, and cut 67,550 feet of trocha for running profiles.

*Culebra Cut.*—During the fiscal year 16,221,672 cubic yards were excavated, and from estimates prepared on July 1, 1911, there remained 23,929,140 cubic yards to be removed in order to complete this section of the canal. It will be noted from the amount remaining that the estimate has again been increased over that reported a year ago by 4,676,278 cubic yards. This is necessary to allow for the slides which have developed beyond the limits assumed in the preparation of the former estimates. The total amount of material removed during the year outside of the slope lines and because of slides aggregated 4,879,378 cubic yards, or 30.07 per cent of the total amount of material removed from the cut, as against 15 per cent during the previous fiscal year. Thus far 10,757,658 cubic yards of material

due to slides have been removed, and the estimated amount remaining is 5,868,120 cubic yards.

Slides follow the excavation in places where the material is left at a steeper slope than it will assume in its natural state, in which case it sloughs off until the natural slope is reached and the movement ceases. The amount of material to be handled is relatively small and as a rule such slides are not troublesome.

In other parts of the cut layers of clay overlies smooth surfaces of rock or other material harder than clay sloping toward the axis. Excavating the material removes the pressure which previously existing held the clay in place. The overlying mass slides or slopes down into the lower area, the heavy rains assisting the movement. Thus far the only way of handling these slides is to remove the material as it enters the cut. In some cases all of it must be taken out, while in others only a portion, the amount depending upon the slope of the rock and the character of its surface. They are troublesome in that they interrupt the drainage and upturn tracks, thereby interfering with the progress of the work. Experience shows, however, that it is only a question of time when they will cease entirely.

In addition to the slides, breaks have occurred, notably on both sides of the cut at Culebra. At localities where these have taken place the underlying rock is of poor quality, intersected by vertical seams or seams sloping toward the canal. As the excavation progresses, the distribution of the weight is changed, until by the concentration which follows, the breaking point of the weak stratum is reached and it is broken up and squeezed out of place, thus causing a heaving of the bottom or a pushing out of the side slopes, or both. A settlement of the overlying mass follows, accompanied by a movement toward the cut. Though the causes in the case of the slides and breaks differ, the effect is practically the same. The heaving of the bottom, or the pressing together of the sides of the shovel cut below, interferes with the drainage, covers or overturns the tracks, and interferes with the progress of the work. The rational method of treatment in these cases seemed to be to relieve or reduce the pressure as much as possible, and work along these lines was directed in the latter part of the dry season on the west side of Culebra Cut, and has been so successful that a point has been reached so that the shovels at the bottom are not interfered with, and are enabled to move ahead without bulging due to pressure from this side. Intermediate benches along the slope are cut so as to distribute the top weight and reduce the amount of material that may have to be removed. Work was started similarly on the east side along the same lines. By carrying out this plan, when the bottom grade of the canal is reached it is apparent that no further trouble need be anticipated and that greater stability will be given by the water. It therefore appears



that with both slides and breaks the question is one of ultimate amount of excavation, and, whatever the feeling elsewhere, there is no apprehension on the Isthmus as to the final outcome among those who are acquainted with the facts and who have given the matter any thought.

The geological formation of the Isthmus is very irregular and the character of material encountered in the cut is constantly changing, so that it is impossible to determine in advance where slides and breaks are liable to occur, or when they do occur, the slopes which they will ultimately assume. Because of this uncertainty, it is not economically practicable to terrace the banks everywhere in advance of the movements, nor is it possible to estimate with any accuracy the amount that will have to be moved eventually due to slides, which explains the necessity for increasing the amount of material to be removed on July 1, 1911. The estimate of the amount remaining due to slides may not be reached; on the other hand it may be exceeded. It is to be noted, however, that six of the good-sized slides which have given trouble in the past are now quiet, with no indication of further movement, and the work of deepening the cut and widening the lower reaches has progressed satisfactorily with less interruption or interference on account of slides than at any time since trouble with them began.

Thus far, also, the increases in the estimates of material to be removed made necessary by the slides will cause no increase in the total estimated cost for Culebra Cut, due to the reduction in the unit cost of the work effected by the increased efficiency of the organization; furthermore, there is no indication that such increases will delay the ultimate time of completing the work, because the progress has been greater than anticipated, and by working on the upper reaches of the slopes the output has been maintained.

Of the slides proper the one heretofore of greatest importance was that at Cucaracha, which covered 47.1 acres. Up to July 1, 1911, 2,722,164 cubic yards of material had been removed, and there remain 400,000 cubic yards. The last shovel cut at the foot of Cucaracha slide was made in the first part of June, 1911, on the permanent berm at the 95-foot level, since which time there has been no sign of any movement, the slide apparently being "dead."

The next largest slide heretofore noted was the Culebra slide, first reported as covering 7.3 acres. Since then, it has developed on both sides of the cut so that it now covers 46.6 acres, and at the present time is the most troublesome of all. On the east bank opposite Culebra it is estimated that 2,329,784 cubic yards had been removed, and there remain 1,664,350 cubic yards. On the west bank, 3,714,562 cubic yards have been removed and there remain 3,391,300 cubic

yards. The other slides have diminished in importance, and further details regarding them can be found in Appendix C.

The summit of drainage in the cut was at Empire, and water entering to the south of this point was drained into the Pacific Ocean by pumping from a sump at Pedro Miguel. Eight pumps of various types available on the Isthmus were utilized having an aggregate capacity of 38,250 gallons per minute. Arrangements are in progress for draining through the center culvert of the Pedro Miguel Locks, which will eliminate the pumps at this end, and gravity drainage south of the summit will result. The dike separating the cut on the north side from the Chagres River remained intact. An additional pump was installed and the water flowing to the north of the summit was drained to the sump at the Bas Obispo end of the cut, from which it was pumped into the Chagres River. There are installed eight pumps of various types, having a total capacity of approximately 59,290 gallons per minute. The piston pumps can be operated by air or steam, so that they can work under water for a considerable time.

The diversion channels for carrying off the waters of the Obispo River and its tributaries were described in a previous annual report, and, as already noted, the waters of the Obispo River broke into the canal through the break at La Pita point. At that time the water was checked and handled through a wooden flume, and this was utilized until January, when a reinforced concrete flume 7 feet high, 22 feet wide, and 400 feet long was commenced and completed in April. This flume has a maximum discharge capacity of 3,000 cubic feet per second, or 15 per cent more than the greatest recorded flow at this point.

The slide on the east side of the canal opposite White House, in October, 1910, broke back to the Obispo diversion dike. Had the slide developed to a greater extent the water of the diversion would probably have broken through the dike. To avoid this possibility a new channel was cut through a saddle so as to carry the waters about 1,000 feet farther from the canal at this point, necessitating the excavation of 22,416 cubic yards. The work was done partly by hand and partly by mule teams and scrapers.

As the depth of the cut has increased, egress therefrom for the dirt trains has become more and more limited, resulting in a decrease in the number of dumps that could be economically utilized. Trains were run from the south end of the cut at Pedro Miguel to the dumps at Balboa and Miraflores, and from the north end of the cut to the Gatun Dam, Tabernilla, and over the Gamboa Bridge to dumps on the Panama Railroad relocation. Several new dumps of limited capacity were opened in the Chagres section to take care of local excavation. The Tabernilla dumps were closed after December 12,

1910, and on them were wasted 1,008,098 cubic yards during part of the year; at Miraflores, 3,478,706 cubic yards were wasted; and 4,646,841 cubic yards were dumped at Balboa in reclaiming land from the ocean and also in raising part of the area previously reclaimed. An additional 62 acres were reclaimed during the year, making a total area of 315 acres. The amount of material delivered at Gatun for the dam, backfill for the locks, and large stone for the concrete was 2,230,438 cubic yards, car measurement, and consisted of "run of the cut." A greater part of the material hauled out on the relocation of the Panama Railroad between Caimito and Gamboa was wasted; 3,509,221 cubic yards were disposed of over this section. The average haul to the dumps was 12 miles.

On account of the character of the material excavated in the Chagres section, two new methods of disposing of material were devised; one by washing the material so as to cause it to slide into the Chagres River, which washed it away; and the other by so dumping from a trestle as to utilize the current of the river in carrying away the material dumped therefrom.

As previously reported, a breakwater was started from Balboa toward Naos Island with the object of cutting off silt-bearing currents from the excavated channel in the Pacific, thereby reducing the cost of maintenance and making navigation of the channel easier by eliminating the cross-currents. Prior to June 30, 1910, the trestle had been constructed for a distance of 2.4 miles. During the year just closed this trestle was extended 2,006 feet so that the trestle was 2,737 feet from Naos Island. The filling, however, extended to within 1,500 feet of the end of the trestle, or a distance of 4,237 feet from the island. A great deal of trouble was experienced in extending the outer end of the dike, due to sliding of the bottom caused by the weight of the material dumped from the trestle. This sliding was encountered at every foot of the last 4,000 feet of the dike and resulted in a settlement of the roadbed, which continued for the first two or three months, after which it gradually diminished and finally ceased. So far the work has been of material benefit to the channel.

The average cost for excavation for the year, including all items which enter into its accomplishment, was \$0.5880 per cubic yard. At the close of the year the Culebra Cut was 73.25 per cent completed.

The Empire shops continued under the charge of the central division, making shop repairs and manufacturing repair parts for the steam shovels in use on the canal. The total number of shovels repaired during the year was 35. A night gang for field repairs was maintained, as heretofore reported. Two oil furnaces were installed in the blacksmith shop to secure more economical results in certain classes of work.

*Municipal work.*—The road under construction between Empire and Paraiso, which was in progress during the previous fiscal year, was completed on October 1, 1910, resulting in a highway 12 feet wide and 18,800 feet long. The road between Empire and Gorgona was completed on June 28, 1911, giving a highway 12 feet wide and 16,810 feet long. A reenforced concrete bridge was constructed to carry the road over the Mandingo River near Bas Obispo. It is 12 feet wide and 196 feet long, containing 556 cubic yards of concrete. As the result of this work a wagon road is opened up from Panama city to Gorgona. In April, 1911, work was commenced on the Empire-Chorrera road. It will be a 16-foot macadam road, about 6 miles long in the Canal Zone, and is to be extended by the Panamanian Government to Chorrera, a distance of about 20 miles farther. One mile of subgrading, with the necessary culverts, has been completed. A road from West Culebra to Cowpens, a distance of 3,200 feet, was started in May, 1911, and by June 30 was about 75 per cent completed. In Golden Green, a settlement between Empire and Culebra, 1,600 feet of street were macadamized. Approximately 60 miles of trails were cleaned and drained, the labor being done by natives working out their poll taxes. General repairs were made to existing roads and to cinder paths.

Water pipe laid, removed, and relaid aggregated 24,684 feet, and sewers laid, removed, and relaid aggregated 8,827 feet.

Sanitary work consisted of digging 7,177 lineal feet of ditches, regrading 291,474 lineal feet of ditches, cleaning 1,707,517 lineal feet of ditches, laying 1,762 lineal feet of tile drains, constructing 5,445 lineal feet of concrete gutters, cleaning 99,515 lineal feet of concrete drains, and clearing 58,501 square yards of brush and grass.

Further information concerning the operations of the central division is given in Appendix C.

#### PACIFIC DIVISION.

The work of this division consists of the construction of the locks and dam at Pedro Miguel; the locks and dams at Miraflores; the Ancon quarry; dredging for sand at Chame; excavating a channel between the locks and below Miraflores locks to deep water in the Pacific; such municipal work as may be required within the territorial limits of the division; and such sanitary engineering work as may be prescribed by the sanitary department within the same area. The work is in charge of Mr. S. B. Williamson, as division engineer.

*Pedro Miguel.*—The excavation of the lock chamber, including the slides which had developed, was completed during the fiscal year by the removal of 16,423 cubic yards at a cost of \$0.5991 per cubic yard. In addition, 76,847 cubic yards were handled during the year in preparing the foundations at a cost of \$2.3746 per cubic yard.

The greater portion was removed with picks and shovels, loading into skips which were handled by locomotive cranes or derricks; steam shovels, however, were used wherever practicable.

The construction plant in its entirety began operations on July 15, 1910, and continued as a whole until January 31, 1911, when dismantling the plant was begun preparatory to moving it to Miraflores, under a contract which was made for taking down the cranes and reerecting them at Miraflores. The total amount of concrete laid during the fiscal year at Pedro Miguel was 498,187 cubic yards at a cost of \$4.7141 per cubic yard. Of this amount 376,657 cubic yards were laid by the construction plant and the remainder, 121,530 cubic yards, was supplied by three 2-cubic-yard auxiliary mixers and by two  $\frac{1}{2}$ -yard portable mixers. One of these large mixers was located at the south end of the east wall and the other two in the forebay; one at the south end of the east storage trestle and the other at the south end of the west trestle; those in the forebay were subsequently combined at the south end of the west trestle to make way for the drainage of the central division through the middle wall culvert. The total amount of concrete that had been laid in the Pedro Miguel Locks at the close of the year was 665,056 cubic yards, and, as the estimated amount remaining July 1, 1911, was 172,345 cubic yards, the lock was 79.42 per cent completed on that date.

The concrete supplied by the construction plant was mixed on the berm cranes and transported by a narrow-gauge railroad to the chamber cranes which placed it in the forms. There were two berm cranes in operation for 181 days and one berm crane for 93 days in addition; they worked on a basis of an 8-hour day, averaging, however, 8.88 hours per day, and the four mixers connected with them produced at the rate of 70.30 cubic yards per mixer per hour of actual working time, and 50.09 cubic yards per mixer per hour of service time. The berm cranes while in service were engaged for 71.26 per cent of the time in supplying concrete, the rest of the time was taken up in making repairs and waiting for cars. The chamber cranes laid a total of 401,725 cubic yards of concrete and 1,430 cubic yards of large rock during the year. They were operated on the basis of an 8-hour day, and they averaged 43.64 cubic yards of material per hour service time, and 64.71 cubic yards actual working time. The auxiliary mixers operated on the same day basis and produced 35.63 cubic yards per mixer per hour working time, and 20.52 cubic yards service time.

Back filling behind the side walls was continued intermittently throughout the year; the total amount placed was 273,709, including 1,434 cubic yards in center wall, at a cost of \$0.3900 per cubic yard. The filling was completed at the north end of the west wall to provide the yard required by the gate contractors.

The west dam at Pedro Miguel can not be completed until the drainage of the central division is diverted from the site. This will be done as soon as certain concreting in the forebay of the east lock is completed, when the water will pass through the middle culvert. For this reason, no filling was added to the dam in the past year. A trestle was driven in continuation of the west toe toward the north, and operations will be resumed during the next dry season.

*Miraflores.*—The excavation by steam shovels in the upper lock had been completed except that removed in preparing the foundations, aggregating 137,752 cubic yards of material, which was removed at a cost of \$1.6085 per cubic yard.

The construction plant, as outlined in the last annual report, is to consist of four berm cranes and four chamber cranes. Of these, two berm cranes were partially erected at Miraflores consisting of the towers and movable booms; the one of the east side was completed on September 2 and placed concrete supplied by auxiliary mixers until the erection of the cantilever arm taken from one of the berm cranes used in the forebay of Pedro Miguel began on February 15, 1911, when the mixers were placed in position. This machine was finally completed and began operations as designed March 22, 1911. The second one was assembled on the west side of the lock site; the fixed cantilever arm was in position, the wiring completed, and it was put in commission on April 7, 1911. The third was under erection on the west side, and the fourth was being dismantled at Pedro Miguel. As described in the last annual report, the chamber cranes were to operate in connection with the berm cranes, receiving concrete from the latter and placing it in the middle wall; two chamber cranes to operate, one in each lock of the upper pair, and the other two one in each lock of the lower pair. Before the chamber cranes were transferred to Miraflores, the manner of using these cranes was changed; two of them are to be reerected in the east lock of the upper pair with the longer arms extending over the center wall, and concrete is to be supplied by a portion of the narrow-gauge equipment moved from Pedro Miguel from two auxiliary mixers erected in the east wall. By this arrangement two additional mixers were added to the plant, and the chamber cranes can handle concrete to both sides of the center wall. The moving of the first berm crane was begun on April 20, 1911, and the second on May 9; the former had been assembled ready for wiring at the close of the year, the latter was in course of erection.

Prior to the transfer of the plant, concrete was laid by means of an auxiliary plant consisting of two 2-yard mixers and four one-half-yard mixers. The former were installed in the east storage trestle until they were removed to a position on the east wall for supplying concrete to the chamber cranes. The one-half-yard mixers

were portable and were used for placing concrete in the floors, lateral culverts, miter walls, and foundations for the main walls. The total amount of concrete placed in the Miraflores locks during the year was 272,933 cubic yards, at a cost of \$4.6826 per cubic yard. The partly completed construction plant placed 67,678 cubic yards, and the remaining 205,255 cubic yards were supplied by the auxiliary plant. The average number of mixers of the construction plant in operation from March 22 was two, and, working on a basis of an 8-hour day, produced on an average 25.53 cubic yards per mixer per hour in service and 41.69 cubic yards per hour working. The total amount of masonry (concrete and large rock) laid by this division in the locks on the Pacific side was therefore 771,120 cubic yards, or at the rate of 281.299 cubic yards per service hour.

The storage trestles on both sides of the locks were completed and 156,571 cubic yards of crushed stone and 164,980 cubic yards of sand were placed in storage. The various types of forms used are the same as were described for Pedro Miguel in the last annual report. Some of these were transferred from Pedro Miguel to Miraflores after their service at the former place had ceased.

The east wall of the upper lock has been partially back filled, 53,521 cubic yards of material having been placed at a cost of \$0.4293 per cubic yard. The total amount of concrete to complete the Miraflores locks is 1,424,563 cubic yards, so that the locks at the close of the fiscal year were 19.27 per cent completed.

The hydraulic excavating plant began operations in the lower lock of Miraflores during the latter part of September, 1910, and continued until February, 1911, by which time practically all the overlying material had been removed; steam shovels were then resorted to for removing the rock. The hydraulic plant removed 332,703 cubic yards, at a cost of \$0.5486 per cubic yard, the greater part of which was pumped into the Miraflores Dam. At the close of the year the steam shovels has excavated 247,700 cubic yards at a cost of \$0.7378 per cubic yard, the material being used in the Miraflores Dam and back fill for the locks at Pedro Miguel.

*Stone and sand.*—Broken stone for concrete is furnished by the quarry on the west side of Ancon Hill, which was operated throughout the year, with the exception of six days lost by breakdowns and to replace a main shaft on the No. 16 crusher. The formation of the rock is seamy, and the seams are filled with clay. To exclude this from the crushed product a screen was added. The total amount produced by the plant was 855,824 cubic yards, at a cost in the bins of \$0.7113 per cubic yard. The quarry was operated on a 9-hour day basis, except from December 1 to April 4 when a 12-hour day was in force, and produced 281.61 cubic yards per hour service time, and 379.53 cubic yards per hour actual working time. Of the total

amount crushed 808,767 cubic yards were for use in the locks; 35,382 cubic yards were used for work in the division other than the locks, of which 16,505 cubic yards were for municipal work, and 11,675 cubic yards were supplied to other divisions and departments. The quarry also furnished 76,411 cubic yards of large rock for back filling the lock walls and other purposes. The cost of stone delivered in the stock piles was \$0.8443 per cubic yard.

Sand was obtained from the bay formed behind Chame Point, 20 miles west from Balboa. It was dredged by a ladder dredge into barges of 500 cubic yards capacity and towed to Balboa, where it was transferred by the rapid unloading cranes to bins. The total amount produced during the year was 494,841 cubic yards, at a cost of \$0.6331 per cubic yard delivered in the bins. Of this amount 465,426 cubic yards were used by the Pacific division, 19,814 cubic yards were delivered to the Atlantic division, and 9,601 cubic yards were sold to other departments. The cost of the sand at stock piles was \$0.8284 per cubic yard. Sand was unloaded from barges to bins by three electric cranes, two being operated eight hours per day and one held in reserve; 494,841 cubic yards were unloaded during the year, being on an average of 101.87 cubic yards per hour in service, or 144.32 cubic yards per hour working, at an average operating cost of \$0.1415 per cubic yard, exclusive of charges for plant.

The hydraulic excavating plant began work in September, 1910, and deposited 444,145 cubic yards of impervious material from the canal prism to form the hydraulic fill of the west dam at Miraflores. In addition, 295,598 cubic yards of dry fill, obtained from the excavation of locks, were added to the dam. On May 24, 1911, the temporary spillway used for draining the water from the hydraulic fill gave way, through the undercutting of the outer toe, and about 96,000 cubic yards escaped. A large portion of the material moved around into the Miraflores Lock pit and seriously interfered with the prosecution of the work. This dam is 83 per cent completed.

*Channel between locks and the Pacific Ocean.*—During the last five months of the fiscal year, 197,880 cubic yards of material were excavated in the dry by steam shovels between the Pedro Miguel and Miraflores Locks at a cost of \$0.6888 per cubic yard. The material was used as backfill for the Pedro Miguel Locks.

In the area between Miraflores Locks and the Pacific Ocean, excavation was done by the hydraulic excavating plant and by dredges. After completing work in the lower lock chambers in February, 1911, the dredging units of the hydraulic plant were moved into the sea-level section of the canal, where they have since been operated. Numerous large boulders and sunken logs encountered in the process of sinking the barges on which the dredging pumps were installed,



and the existence of rock requiring blasting at a higher level than the borings indicated, prevented the barges from settling to the grades desired, and in some instances injured the bottoms. For this reason the barges were abandoned and the dredging pumps placed at intervals along the axis of the channel with their suctions in sumps extending slightly below final grade. Two of the pumps were installed in this manner and the third was still operated from a barge. The amount removed from the channel by this process outside of the lock chamber was 197,677 cubic yards, at a cost of \$0.6106 per cubic yard in place. This cost is greater than anticipated, but since the dredging pumps can handle rock after it is blasted, which was not contemplated, the resulting cost is less than the combined cost of dredging equivalent amounts of earth and rock. Of the amount so removed, 111,421 cubic yards were placed in the dam at Miraflores and 86,253 cubic yards were used in reclaiming swamps east of the canal channel.

The dredges operating in the channel during the year were the 20-inch seagoing suction dredge *Culebra*, one 5-yard dipper dredge, and three French ladder dredges. The suction dredge operated over a length of 7.5 miles of the canal, measured from the sea end, and the others between the point reached by the *Culebra* and the area inclosed for operation of the hydraulic plant. They removed from the channel a total of 5,549,642 cubic yards at a cost of \$0.2519 per cubic yard. At the close of the year there remained a total of 4,693,211 cubic yards to be removed from the channel south of Miraflores, including an estimate for siltage.

Below a point 7 miles from the Pacific entrance to the canal the rock in the prism lies in separate shoals of small area and volume, which are removed by subaqueous methods, heretofore described. The rock breaker *Vulcan* was operated by two 10-hour shifts until March, 1911, after which one shift only was used, as the shoal had been removed to a depth that made it impossible to work economically a greater length of time, due to the range of tides. The area covered by the rock breaker aggregated 648,033 square feet, and the amount of material removed after breaking was 49,266 cubic yards. The drill barge operated throughout the year with two 10-hour shifts per day, and drilled and blasted an area of 247,560 square feet, from which the dredges removed 1,300 cubic yards. This amount of material was removed in the month of May, and should not be taken as an indication of the capacity of the drill barge, as all the rock broken by its operations during the year was not taken out on account of lack of available dredges, the above-mentioned amount having been removed in order to determine whether or not a sufficient amount of explosives was being used to properly shatter the rock. Work was

continued until April 4, 1911, with the well drills operating through the overlying earth by means of pipe casing. The estimated amount of rock broken up by this method was 251,812 cubic yards; 251,819 cubic yards were dredged.

Miscellaneous dredging consisted in excavating a channel to the lumber dock under construction, 705,465 cubic yards; deepening the berths in front of the sand dock, 17,200 cubic yards; the Panama Railroad Co.'s commercial and coaling docks, 15,633 cubic yards; shipways, 19,400 cubic yards; and at the hydraulic pumping plant, 18,000 cubic yards.

No new equipment was assembled or erected during the year by the Balboa shops and shipways, but all necessary running repairs were made to the plant and floating equipment at these shops. The equipment in addition to the dredges already enumerated consists of 4 tugs, 7 scows, and 12 barges.

*Municipal and sanitary works.*—In addition to the municipal improvements carried on in Panama under a separate appropriation made by Congress, the plant described in the last annual report as installed at Cocoli Lake was increased by the installation of an 8-inch motor-driven centrifugal pump to lift the water from the lake to the mixing tanks, which enables the use of both of the 10-inch pumps to force the filtered water through the mains. This addition was made necessary because of demands for increased pressure in the city of Panama. To permit of the excavation of the drainage channel from the central division to the Pedro Miguel Locks and to admit of raising the Balboa dumps the water mains were moved.

The reenforced concrete reservoir at Palo Seco Leper Asylum was completed in July, 1910, and a distributing system constructed. Aside from completing the sewer system at Palo Seco, the work performed during the year consisted in making repairs, extensions, and house connections.

Of the main highway practically parallel to the canal and extending from Panama to Gorgona 3.14 miles were constructed by the Pacific division between Pedro Miguel and Corozal.

Sanitary work consisted in cleaning 511,010 lineal feet of new earth drains, requiring the removal of 3,257 cubic yards of earth; filling swamps and holes at various points, necessitating the handling of 1,063 cubic yards of material; the construction of 6,136 lineal feet of cement drains; and laying 2,509 lineal feet of tile drains.

For further information attention is invited to Appendix D.

#### MUNICIPAL IMPROVEMENTS IN COLON AND PANAMA.

For reasons given in the last annual report, the act of March 4, 1909, making appropriations for the canal, included an item of

\$800,000 for extending the municipal improvements in the cities of Colon and Panama. This amount as expended will be added to the indebtedness previously incurred for this purpose in the two cities, and will have been refunded at the end of the 50-year period through collections of water rents.

*Colon.*—Of the money appropriated, the sum of \$550,000 was allotted for work in Colon, which was to be expended in the construction of the D Street storm sewer and filling in to the east of D Street, so as to give the height of 8.5 feet above sea level at the intersection of Ninth and E Streets, grading down to the elevations reached by the former improvements. During the year the D Street storm sewer, extending from the sea at the Beach Road on the north to Folks River on the south, with outlets at either end and with the summit elevation at Eighth Street, was practically completed, and there had been expended to June 30, 1911, for its construction \$167,285.72. During the year 12,881 cubic yards of material were excavated; 5,000 cubic yards of reenforced concrete installed, and 7,235 cubic yards of back-fill placed. The necessary plans having been prepared, the fill was started on October 31 with one of the 20-inch suction dredges and continued throughout the year, 501,786 cubic yards of fill having been made, at a cost of \$0.3076 per cubic yard, including plant and division charges. The drainage system south of Ninth Street is completed; some work remained to be done north thereof. The paving on D Street was completed except half a block between Thirteenth and Fourteenth Streets. The surface is rather uneven, due to the soft substratum, and additional work will be required to bring it to grade. The sections south of Ninth Street, to and including Thirteenth Street, have been covered with rock, but the surfacing has not been completed. Rock to the extent of 10,918 cubic yards was used in street paving. Because of the cost of Porto Bello rock 5,531 cubic yards of broken stone and about 2,500 cubic yards of sand were procured from the Pacific division for this purpose. A total of 23,800 feet of curb and gutter was placed. During the year \$258,499.72 were expended, making the total cost of improvements to June 30 \$383,640.81.

*Panama.*—Of the amount appropriated by Congress \$250,000 were allotted for improvements in the city of Panama, included within the districts of Guachapali, Santa Cruz, Cocoa Grove, Avenue B, and District I. The work consisted of grading and macadamizing the streets, laying concrete curbs and gutters, together with the necessary sewers and water mains. The work in these districts was completed. In addition La Neveria was graded and paved, and an intercepting sewer laid to prevent the flooding of Central Avenue

and adjacent property. Streets were graded and macadamized and sewers, water mains, and concrete curb and gutters placed as follows:

	Paving.	Curbing.	Sewer mains.	Sewer laterals.	Water mains.	Water laterals.
	<i>Square ft.</i>	<i>Lineal ft.</i>	<i>Lineal ft.</i>	<i>Lineal ft.</i>	<i>Lineal ft.</i>	<i>Lineal ft.</i>
Cocoa Grove district .....	143, 108	15, 996	1, 675	1, 073	2, 519	1, 224
Guachapall district .....	368, 388	32, 468	8, 312	2, 238	8, 469	5, 580
Avenue B .....	71, 424	8, 576	1, 944	712	1, 588	885
Santa Cruz district .....	166, 066	18, 464	7, 875	1, 798	7, 669	3, 828
District I .....	47, 332	4, 982	1, 379	546	1, 187	680

During the year \$94,969.42 were expended, making the total cost of improvements undertaken in Panama \$189,360.63. A survey and plans were made for developing the district bounded by the Zone Line Road, B Street, Fourth of July Avenue, and West Sixteenth Street. The money for this was to be advanced by the Government of Panama, but no work was done during the fiscal year other than selecting certain material needed in the improvements.

For further details in connection with this work, attention is invited to Appendixes B and D.

#### TERMINALS.

The increase in the number of ships touching at the ports on either side of the Isthmus has made it necessary to extend the existing docking facilities. As the act of June 28, 1902, contemplates the construction of terminals for the canal, any addition to the docks should be such as to form a part of the final scheme, which should also include coaling facilities and a dry dock as necessary adjuncts to the canal. A board was appointed on April 24, 1911, to consider and report on the facilities that will be necessary in connection with the use of the completed canal, so that after the general scope and characteristics of these facilities have been adopted such work as may be needed may be undertaken. These facilities were to include the storing and furnishing of coal and other fuel for use both afloat and ashore; the furnishing of fresh water to shipping; the furnishing of adequate and convenient facilities for the repair of all vessels, as well as of all rolling stock, equipment, and machinery ashore; and the question of storehouses and storing of material and supplies on the Isthmus (other than fuel) for all other purposes after the completion of the canal.

A comprehensive scheme was outlined having in view the construction at the Pacific terminus of a dry dock, the permanent shops, and a storehouse for supplies. A coaling station is contemplated at each end and an arrangement of docks which will permit of subsequent additions. The dry dock is to conform in its dimensions to the locks, and the wharves are to be of sufficient dimensions to care

for any shipping which can use the canal; in other words, the docks are to have lengths of 1,000 feet and depths of water equal to the depths provided in the channels of approach.

On the Atlantic side it was decided that the docks should be within the limits of the Canal Zone, located so as not to interfere with traffic through the canal and at the same time to enable shipping to lie at them in safety during storms. To accomplish these objects, negotiations were undertaken to secure part of the waterway north of Cristobal Point, which under the agreement with the Republic of Panama at present in force is under the jurisdiction of the latter. Designs were prepared for the construction of a mole extending in a general westerly direction to the canal prism from the intersection of the shore by the line separating the Zone from Colon and of dimensions sufficient to protect against storms both the docks and the basin which will be excavated to the south of them. During the year the necessary borings were made to determine the depths to rock; trestles were built for the mole and for the first slip of the new dock; tracks were laid from Mount Hope, where material is to be secured from borrow pits, to the mole; and material collected for the permanent construction. This involved the construction of 2,100 feet of trestle and the laying of 7,235 feet of track. This work will be done by the Panama Railroad Co. with its own forces.

On the Pacific side a tentative location was selected for the dry dock and for the permanent shops, and an arrangement made for a scheme of docks. As the docking facilities of the Panama Railroad at Balboa are very much restricted, there was immediate necessity for additional wharves, and under an allotment from the Panama Railroad of \$428,700 a reenforced concrete dock 706 feet long and 55 feet wide was begun; at the request of the Panama Railroad Co. the work is to be carried on by the forces of the Pacific division.

In the construction of the new dock at Balboa a test pit was sunk and a line of borings was made along the outer edge of the proposed dock. Sand is encountered for about 20 feet, below which is a heavy bluish-gray clay upon a layer of gravel and sand overlying the rock. The latter is at depths varying from 60 to 70 feet below mean sea level. In the construction of the pier, caissons made of heavily reenforced concrete shells will be carried down to rock and ultimately filled with concrete. The bottom section of the caissons has an exterior diameter of 10 feet at the base, tapering to 8 feet at the top, from which the piers rise with the same thickness to the top; the interior diameter is 6 feet throughout and the sections are cast 6 feet in height. The caissons will be connected by tie-girders 3 feet 6 inches deep by 2 feet 6 inches wide extending transversely between the piers, and longitudinally between outside piers at an elevation of -10. The floor system will consist of girders running perpendicular

to the axis of the docks, with a cross section of 4 feet 8 inches deep by 2 feet 6 inches wide. These girders will support a system of floor beams running longitudinally along the dock 3 feet 9 inches deep by 1 foot 3 inches wide, on top of which will be placed slabs 6 inches thick. Work was begun on the caisson construction during the last week in February; and on July 1 five caissons had been sunk to rock and 16 were in process of sinking; there are 55 caissons in all.

For further details concerning the general scheme of terminal facilities see Appendix F; and for the construction of Balboa dock, Appendix D.

#### CONSTRUCTION OF NEW PANAMA RAILROAD.

The construction of the new or relocated line of the Panama Railroad was continued by the Panama Railroad Co. during the year, and was in charge of Lieut. Frederick Mears, United States Army, as chief engineer of the Panama Railroad Co.

All grading on the line from Gatun to Gamboa was practically completed at the beginning of the fiscal year, except for about 3 miles where the line crosses the valleys of the Quebrancha, Brazo, Baja, and Gatun Rivers. The ground level of the Quebrancha bottom is at an average elevation of 20 feet above sea level, while soundings indicate that rock is from 150 to 180 feet below this elevation and that it is overlaid with a deposit of soft sandy clay, with a harder stratum of clay and pure sand near the surface of the ground. As the height of the embankment across the bottom averages 71 feet it was necessary to spread out the base of the fill so that if possible the weight would not disturb this upper stratum sufficiently to squeeze out the softer material below. With this in view the first fill was carried up to elevation 50 and out to 2:1 slope stakes. After this fill was made a trestle to elevation 70 was driven across it and filling from this level was started. A small settlement occurred along the trestle with a corresponding upheaval beyond the slope stakes and additional counterweight was added on both sides well beyond the stakes, after which the raising of the center line to permanent grade was continued. On June 30, 653,505 cubic yards of material had been placed in position.

Across the Brazo bottom the original elevation was about 30 feet above mean tide, necessitating the construction of an embankment averaging 60 feet in height. The filling across this bottom has given no trouble and 1,112,036 cubic yards have been placed.

The Baja bottom has given trouble from the time that filling began. The elevation of the natural ground is about 25 feet and the depth to rock is about 60 feet; the overlying material, however, is the softest kind of clay intermixed with decomposed wood and vegetation. As the embankment settled additional weight was put along

the toes and in this way the fill gradually raised until at the close of the year it was about 10 feet below grade. The average fill over the valley is 67 feet, and at the close of the fiscal year 495,925 cubic yards of material had been placed in the fill.

The Gatun River bottom at the crossing of the railroad line requires a fill averaging 62 feet in height. A permanent bridge is to be located at this point and the embankment at the bridge is to be raised to plus 97. A small settlement occurred on the south end of the Gatun River Valley, which rolled and pushed up the natural ground for a distance of between two and three hundred feet. This has been well filled over and counterweighted. The total amount of material placed in this fill to the close of the fiscal year was 932,238 cubic yards. As but few main line cuts remained to be excavated at the close of the last fiscal year, the greater part of the material for the fills across these valleys was secured from borrow pits.

The reenforced concrete piers for the permanent bridge across the Gatun River were built during the dry season. They are designed to carry the three plate girders which now form the north span of the Barbacoas Bridge in the operated line. A creosoted pile bridge was driven to the west of these piers, to be available for operation during the dismantling of the Barbacoas Bridge, and for the erection of the girders. To give access to the upper Gatun Valley, one span of the bridge will be of the bascule type.

Under the original plans for the relocation of the Panama Railroad, the operating track was to be carried through Culebra Cut on the berm at elevation 95. Because of the slides which developed along the east side of Culebra Cut, and the necessity of maintaining through communication when the present line is flooded, the permanent location on the berm line through the Culebra Cut had to be abandoned, and a high line around Gold Hill was adopted and will be used until the condition of the banks through the Culebra Cut permit the return to the original location. The necessary surveys for the location of the high line were begun in July, 1910, and construction commenced January 1, 1911. This location necessitates a  $1\frac{1}{2}$  per cent grade and a maximum curvature of  $7^{\circ}$ . The cuts and fills about balance at 1,250,000 cubic yards. The length of the line is  $9\frac{3}{8}$  miles from Gamboa to Paraiso. The new culverts will require the placing of 9,000 cubic yards of concrete, and the new fills will necessitate driving  $2\frac{1}{2}$  miles of temporary trestle.

During the year 696,742 cubic yards of excavation were completed; 7,035 cubic yards of concrete placed; 11,446 lineal feet of trestle driven; 53,639 lineal feet of temporary track laid; and 257 acres of clearing done.

The construction of the permanent telegraph and telephone line was undertaken during the year, and was built of 56-pound steel rails

for poles, each equipped with four cross arms, 10 pins to the arm, making a 40-wire line. On June 30 the line from Gatun to Gamboa Bridge was 50 per cent completed.

On the completed section of the line, near Gatun and south of Monte Lirio, 6 miles of 90-pound steel rails were laid in large part on hardwood ties. Ballasting operations were continued throughout the year along the permanent track, Chagres River gravel being used for this purpose. The section of relocated line from Paraiso Junction to Corozal Junction was formerly turned over to and accepted by the Panama Railroad Co. on September 4, 1910, since which date it has been operated.

In order to complete the excavation of the central division through the Chagres section at Tabernilla and San Pablo during the next dry season, it will be necessary to interrupt the operation of the old line, and to this end every effort is being made to complete the new line from Gatun to Gamboa by January 1, 1912.

For further details concerning this work, attention is invited to Appendix E.

#### MECHANICAL DIVISION.

The second division of the chief engineer's office has charge of all mechanical questions that may arise and supervises expenditures, the preparation of estimates, and allotments for work. If the dry dock and coaling stations are to be constructed, the design of this work is to be placed under this division. It is in charge of Mr. H. H. Rousseau, United States Navy, as assistant to the chief engineer.

The construction work requires that all mechanical appliances of every character be kept in thorough repair, so that they can be operated without breakdown at their highest efficiency throughout working hours. This necessitates a considerable organization and proper facilities for the inspection, maintenance, and repair of all mechanical appliances. To this end shops are provided at convenient points along the line of the canal, certain ones of which are under the supervision and control of the division heads, and others constitute the central manufacturing and repair plant at Gorgona, with outlying subordinate shops and engine houses.

As noted in the last annual report, an inspector of shops was added to the organization, and from the experience gained his duties were more clearly defined, embracing jurisdiction of all the shops of both the commission and the Panama Railroad Co. The result has been more economical performance of work as well as more efficient and satisfactory service. At the close of the year the number of employees in all the shops on the Isthmus totaled 4,405, of which



1,532 were gold employees and 2,873 were silver men. The number of hourly gold men taken on during the year was 94 per cent of the force employed, indicating that the average length of service on the Isthmus for the mechanical trades continued to be about one year.

A new shop was erected and put in operation at Toro Point for repairing locomotives, cars, and other equipment used in the construction of the breakwater. It was equipped with machines taken from other shops. The shed at Pedro Miguel shop used for repairing cars was doubled in size to save the time previously lost by workmen during rains. At the Gorgona shops an addition to the erecting shop was made for the pipe, tin, and copper shop, so as to move the equipment therefor from the boiler shop, the latter needing additional space. A small building was erected for the oxy-acetylene plant, and a small building was erected and provided with a 25-ton crane, affording facilities for making large iron castings. An order has been placed for a steel casting plant consisting principally of a 2-ton converter, blower, and sand grinder, and when installed the stock of steel castings kept on hand can be reduced and the practice stopped of making repair parts urgently required of cast iron and brass. The permanent equipment was augmented by the addition of one 6-inch turret lathe for making bushings, two heavy milling machines for cutting gears and general work, one automatic tool grinder, an oxy-acetylene plant, one washer cutter for making washers out of scrap metal, a 25-ton overhead crane for use in the foundry, and a Taylor-Barth belt outfit.

With the approval of the division engineer, work in the Cocoli shop was transferred to the mechanical division on September 1 and the shop closed on September 15. The Lirio planing mill was closed and the manufacture of woodwork was consolidated at Gorgona. The keeping of a permanent gang of craftsmen and helpers for making repairs to the cableways and concrete mixers at Gatun Locks and day repairs to steam shovels was done away with. The consolidation of heavy repairs at Gorgona and the transfer of repairs to vessels and other apparatus in the vicinity of Colon and Cristobal to the dry-dock shops enabled the closing of the blacksmith, machine, boiler, and erecting shops of the Panama Railroad in Cristobal. So that repair and manufacturing work could be done with greater dispatch, night shifts were put in the machine, erecting, and boiler shops in Gorgona in August and September. While work of the class involved is usually more expensive when performed at night than during the day, the night shifts have proven efficient and save expense by the elimination of overtime. Another advantage was in reducing the length of time required for completing urgent orders. By putting on a night shift in the wood-car repair shop on February 1, Lidgerwood flats which were cut out of service for light and medium repairs on one day were returned to service the next morning.

According to the present program of work, the Gorgona shops will be retained in operation until the waters of Gatun Lake reach elevation 70. By that time, the manufacturing and repair work, especially in connection with locomotives, cars, and excavating machinery, will have largely diminished and steps can be taken for the erection of the necessary buildings to which the transfer of machines now at Gorgona can be made at that time. The shops at Balboa and at Cristobal now in operation, together with the Panama Railroad machine shops, which, while closed are not dismantled, will afford the necessary repair facilities while the transfer of the machinery from Gorgona is in progress.

At the beginning of the fiscal year an additional traveling engineer was appointed to have supervision over fuel and oil consumption and to supplement the work of the other two traveling engineers, whose jurisdiction extended to locomotives only, and later to supervising and instructing engineers in respect to handling oil, and the firemen in regard to methods of firing and fuel consumption. The duties of the new traveling engineer covered steam shovels, unloaders, spreaders, and all stationary plants, and was subsequently extended to the marine equipment. Very satisfactory results have been accomplished in saving both in fuel and in lubricants.

Electric current for lighting and power was generated at five stations, located at Balboa, Miraflores, Empire, Gorgona, and Gatun. The output of the Gatun and Miraflores plants was largely used in construction work in the Atlantic and Pacific divisions, respectively. The cost per kilowatt hour averaged \$0.026. Oil fuel was used in all stations. Current was generated at the Gatun and Miraflores plants by steam turbines, at the Empire and Gorgona plants by noncondensing engines, and at the Balboa plant by condensing engines.

The principal air-compressor plants are located at Las Cascadas, Empire, Rio Grande, and Balboa, and furnish compressed air to the central and Pacific divisions, and along the high line around Gold Hill on the relocation of the Panama Railroad. The total output from these plants aggregated 8,261,199,541 cubic feet, at a cost of 0.0324 ¢ per thousand cubic feet. Compressed air for the Gorgona shops is furnished by a smaller plant located there.

The total appropriations made by Congress available to June 30, 1911, amounted to \$248,001,468.58, or 66 per cent of the total estimate of \$375,201,000 for completing the canal. By the act approved March 4, 1911, additional appropriations were made for the fiscal year 1912, amounting to \$45,560,000, exclusive of fortifications, leaving \$81,639,531.42 of the total estimated cost of the canal to be appropriated. By June 30, 1911, \$225,470,053.26 had been charged

into the work. Of this amount, \$33,048,607.97 were expended during the fiscal year 1911. The difference between the appropriations available to June 30, 1911, and the classified expenditures to June 30, 1911, amounting to \$22,531,415.32, represents unexpended balances in appropriations; unexpended material and supplies in storehouses; and such items as will not be prorated to construction work until the work is completed: buildings of all descriptions, roads, sewers, and water supplies. Of the total classified expenditures to June 30, 1911, \$27,580,724.37 were for plant and equipment for construction, of which amount \$626,330.86 were expended during the fiscal year 1911.

For further details, attention is invited to Appendixes F and G.

#### RIVER HYDRAULICS, METEOROLOGY, AND SURVEYS.

The third division of the office of the chief engineer is charged with hydrographic and meteorological work, such general surveys as are not embraced within the limits of any of the construction divisions, and such investigations as may be assigned to it. The division has continued in charge of Mr. C. M. Saville, assistant engineer.

A gauging station was maintained at Alhajuela on the Chagres River, and the hydrographer at this station had charge of the gaugings on the upper and lower tributaries. Discharge measurements were begun at Gamboa in November, 1910, and continued since. According to past records, the elevation of the river at Gamboa reached the minimum during the dry season of 1911, and the discharge at this point has been less than on many previous occasions. Bohio was abandoned as a regular gauging station, though measurements of the cross section were taken from time to time to permit gaugings in times of flood. As the entire run-off from the Chagres Basin has passed through the spillway since April, 1910, regular gaugings were made at this point. Back water from the Gatun Lake and the construction of the relocation of the Panama Railroad at Monte Lirio interfered with the permanent stations heretofore maintained on these rivers.

Vigia, Alhajuela, and Gamboa were used as warning stations in times of freshets, and reports were sent to the construction divisions as soon as indications of a rise in the river were noted.

According to the discharge measurements at Gamboa, the heaviest freshet of the year occurred on December 3, 1910, when there was a rise at this point of 12.7 feet and the discharge was 57,200 cubic feet per second. The minimum flow at Gamboa during the year was on March 31, 1911, when the discharge was 700 cubic feet per second.

The three first-class meteorological stations at Ancon, Culebra, and Cristobal were continued during the year, each with a full comple-

ment of instruments. There are also three second-class stations at Gatun, Pedro Miguel, and Gamboa, at which wind direction and velocity, temperature, and rainfall were recorded. Twenty rainfall stations were in operation, 12 of which are equipped with standard and eight with automatic rain gauges. At the request of the department of sanitation, an anemometer was erected at Corozal in February, 1911, for use in studies concerning mosquito migration. For determining the effects of varied conditions on evaporation from the lake surfaces, three evaporation pans, each equipped with a standard rain gauge, and two of them with anemometers, were installed in Gatun Lake in the vicinity of Gatun, one in an exposed location in the open part of the lake about a thousand feet from shore, the second among the trees near the lake border, and the third in an extensive patch of tall rushes. Evaporation stations were also maintained at Ancon, Cristobal, Rio Grande Reservoir, and Brazos Brook Reservoir. An automatic tide register was installed in the canal opposite Corozal, in addition to those in operation at Balboa and Cristobal. Two seismograph stations are in operation for the purpose of recording disturbances, one at Ancon and one erected during the year on Guarapo Island in Lake Gatun near the spillway of the dam in April, 1911.

The temperature for the calendar year 1910 was about normal for all the stations. The highest recorded was  $94^{\circ}$  F. at Ancon on March 13, 1910, and the lowest  $61^{\circ}$  F. at Culebra on March 21, 1910.

The average rainfall over the Canal Zone for the calendar year 1910 was well above normal, being unusually heavy in July and December, but below that of the previous year. For the first half of the fiscal year 1911 the rainfall was below normal. The dry season rainfall for 1910 was above normal. The average rainfall for the calendar year 1910 was 90.83 inches in the Pacific section, 129.18 inches in the central section, and 157.86 inches in the Atlantic section. The average number of rainy days was 220 in the Pacific section, 271 in the central section, and 292 in the Atlantic section, the greatest number being 344 at Monte Lirio and the least 211 at Balboa.

Slight seismic disturbances were of frequent occurrence during the year, very few of which, however, were physically observed in the Zone.

During the year the triangulation survey, which was in progress, was continued, and the primary scheme completed, 15 additional stations having been occupied. For the purpose of connecting the local surveys with the main triangular system a secondary system was established containing 42 additional stations. This triangulation scheme was designed primarily to serve as a framework upon which the Zone lands survey could be hung, and the majority of the stations were established in the vicinity of important section corners. The

adjustment of the secondary system was not completed at the close of the year. The original plan for the survey of the Canal Zone lands, for which a specific appropriation was made by Congress, contemplated the laying out of the lands of the Canal Zone in quadrilaterals 2 kilometers on a side, referring lots and subdivisions to a system of rectangular coordinates. The southeastern part of the Canal Zone, including most of the territory between Las Cascadas and Panama city, was surveyed with this in view. The expense was such, however, that the method was changed, as it was considered neither necessary nor advisable to secure the accuracy attempted, and the remainder of the Canal Zone is being surveyed with a view of locating the principal rivers, mountain ranges, trails, and roads with more topographic detail than the other method contemplated. A number of detailed surveys were made for the land office of the commission and the Panama Railroad Co. after the consolidation of the offices was effected.

The investigations which were continued during the previous fiscal year of the low divides at the headwaters of the Trinidad and Gatun Rivers were continued until January, 1911, when this work was completed. The section explored during the year was between Gatun and the headwaters of the Gatun River. Investigations included the Canoa, the Barro, and the Egronal saddles. The results show that the ridges are of such thickness and composed of such materials as to permit no loss of water from the Gatun Lake. At the Canoa saddle, near the headwaters of the Trinidad, as reported previously, it will be necessary to construct a dike or wall, and similar work will be required at the headwaters of the Las Guacas Creek, about half a mile east of Gatun. On account of the location of the former, this work will not be attempted until the waters of the Gatun Lake are at sufficient elevation to enable easy access to the locality.

For further details, attention is invited to Appendix H.

#### COST KEEPING.

The methods of cost keeping were revised from time to time, and that adopted on January 1, 1910, was continued without change and has given satisfactory results. The costs are reported by divisions and are made up of the labor engaged in and material applied to the work, a plant arbitrary, and a proper proportion of the overhead charges in the divisions. The plant, as a rule, was designed by the division engineers and, within limits, they are responsible for the organization, so that, as between divisions, costs are comparable where the character of the work is similar. To the division costs must be added a proportion of the general expenses of the commission, items over which the division engineer does not necessarily have con-

trol. The cost-keeping accountant, Mr. Ad. Faure, reports directly to the chief engineer, and his duties consist in supervising and verifying the statements of costs furnished by the division engineers, establishing accounts for new work, and preparing statistical reports.

In an examination of the construction expenditures, the central division seems to bear more than its proper proportion of general expenses, due to the fact that prior to 1907 but little work was done except in this division, so that nearly all the overhead charges were properly chargeable to it.

The unit costs produced during the year are lower than at any previous period. The central division produced the lowest cost for excavation, and, as between the terminal divisions, that done in the Pedro Miguel Locks was lower by 11 cents than in the Gatun Locks, but higher by 19 cents than that done in the Gatun spillway. The excavation for the Miraflores Locks was the highest. In the preparation of foundations the Atlantic division did the work for less than the Pacific division. The high cost at Pedro Miguel is partly due to the layout of the work and partly due to changes in designs increasing the amount to be done at a time when the excavation could not be so economically handled.

In dredging, the Atlantic division secured lower costs with the seagoing suction and dipper dredges, and the Pacific division with the ladder dredges. In the latter division an underestimate of quantities to be handled resulted in the total plant charge being absorbed with the accounts for the month of April.

The total amount of masonry laid during the year was 1,741,908 cubic yards in the locks and spillways. In the Pedro Miguel Locks the average division cost was \$4.7040 per cubic yard, and in the Miraflores Locks \$4.6826; in the Gatun Spillway, \$6.7044, and in the Gatun Locks, \$6.5919. The difference between the costs in the Atlantic and Pacific divisions is mainly in the cost of cement, sand, and stone. The bulk of the cement used in the Atlantic division was received in barrels at a cost of \$1.19 at tidewater in the United States, while the Pacific division received its cement in bags at a cost of \$1.60 per barrel, less credits for return of bags. As approximately 90 per cent of the bags were returned and accepted, the cement in bags cost \$1.01 per barrel at tidewater in the United States. The construction plant in the Pacific division also handles a large percentage of its cement directly from the cars to the mixer, thereby reducing cost, while nearly all the cement of the Atlantic division was handled through its storehouse. While the year's operations show a difference in favor of Pedro Miguel Locks of \$1.7340 in the cost of cement, stone, and sand, and large rock, the costs at this locality were also lower for forms, placing, pumping, power, repairs, plant arbitrary, and in division expenses, while a difference exists in favor of the Gatun

Locks in mixing and reenforcement. The construction plant at Pedro Miguel was in operation in its entirety from the 15th of July to the 1st of February, and a comparison of the costs for the six months' period, August to January, with the costs at Gatun Locks for the year shows less cost for all the items than in the Atlantic division except for reenforcement. It is also noted that mixing by the construction plant at Pedro Miguel was \$0.1334 and at Gatun \$0.1749 per cubic yard of concrete. The work at Miraflores was done with the auxiliary plant in order to advance the work at this locality, and is not comparable with the construction plant. The auxiliary plant at Gatun mixed concrete cheaper than the auxiliary plant at Pedro Miguel, due to local conditions, which require a constant train service for supplying of material at the latter place. By the use of large rock in the Atlantic division, of which a total of 73,609 cubic yards was placed, a net saving per cubic yard of material laid during the year of \$0.2888 was secured.

In the production of stone, the cost in the storage bins at Gatun was \$2.3403, and in the storage piles for the locks on the Pacific side it was \$0.8443 per cubic yard. Crushed stone from Porto Bello is transported to Gatun in barges and unloaded by cableways and derricks, while crushed rock from Ancon is transported from the quarry by rail to storage and dumped from trestles. There is, therefore, an extra expense attached to Porto Bello represented by the difference between the cost of towing and unloading and that of transporting by rail of \$0.7184 per cubic yard. If this be deducted from the actual cost in storage, it leaves a cost of \$1.6219 per cubic yard for Porto Bello stone as against \$0.8443 for Ancon stone for similar items in the cost of stone produced at the two places. This is in a measure explained by the harder quality of rock, by the method of quarrying and the layout of plant at Porto Bello. It is to be noted that the cost of production on an 8-hour day basis as compared with a 12-hour day basis is less for the former, both at Porto Bello and at Ancon.

Sand was produced at Nombre de Dios at a cost of \$0.8795 per cubic yard before transportation, or \$1.8565 in storage at Gatun. The Pacific division secured sand at Chame at a cost of \$0.1788 per cubic yard, and its cost in storage was \$0.8284 per cubic yard. In both divisions the sand was transported by water to the point of unloading, the distance being 40 miles on the Atlantic side and 20 miles on the Pacific side. The Atlantic division used cableways and cranes to unload the sand, while the Pacific division used electric cranes. Omitting the cost of transportation from the sand bank to the docks, the cost to the Atlantic division was \$1.3142 and to the Pacific division \$0.6015. A less cost was secured in the Atlantic

division when the 18-inch pipe-line dredge was placed in operation at Nombre de Dios.

In connection with division costs, it is to be noted that the amounts paid for salaries of clerks and supervisory forces amounted to 26.05 per cent for the Atlantic division, 17.8 per cent for the Central division, and 22.95 per cent for the Pacific division.

Effective July 1, 1910, reports of the performance of various parts of the plant were kept and reported, so as to secure some data relative to the operation of the plants.

For further details concerning the cost of the work, attention is invited to Appendix I.

#### QUARTERMASTER'S DEPARTMENT.

The quartermaster's department is charged with the recruitment of labor; care, furnishing, and assignment of quarters; distributing fuel, commissary supplies, and distilled water; construction and repair of all buildings; requisitioning for supplies of all kinds, together with the receipt and distribution of them on arrival; cutting of grass and disposal of night soil and garbage as prescribed by the sanitary department; and the auditing of all property returns. The department is in charge of Lieut. Col. C. A. Devol, United States Army, as chief quartermaster.

Minor changes in the organization of the department were made during the year by the transfer of the Gatun lumber yard from the Atlantic division, effective July 15, 1910; the construction of storehouses for the care of obsolete material, effective August 24, 1910; the transfer of the storehouse at Pedro Miguel from the mechanical division, effective October 11, 1910; the transfer of the construction and repair of sidewalks from the construction divisions, effective September 1, 1910; the transfer of the Panama Railroad storehouse at Cristobal, effective January 1, 1911; the closing of the Lirio planing mill and the transfer of the work and force to the mechanical division, effective April 1, 1911; the transfer of scrap operations from the Panama Railroad, effective April 10, 1911; and the transfer of storehouses containing dredge repair parts at Gatun and Cristobal from the Atlantic division, effective April 15, 1911.

The average number of employees of the Panama Railroad and the commission was at its maximum for the year in January, 1911, when it amounted to 37,271. A minimum was reached in June, 1911, when it fell to 32,690. The average number of gold employees on the rolls of the commission during the year was 4,552; on the rolls of the Panama Railroad Co., 833, or a total of 5,385. During the same period there were 2,896 separations from the service of the commission—employed in the United States, 987, and employed on the



Isthmus, 1,488—indicating that more than 60 per cent of the force was changed during the year, the usual unstable condition of the gold force still ruling.

The past year has been the first since the inception of the work that no contract laborers were brought to the Isthmus. There has been a decided falling off in the immigration to the Zone. The excess of arrivals over departures during the year was 4,910 as against 21,114 during the previous year. The departure of steerage passengers to foreign ports has exceeded the arrivals by more than 1,600, and it is probable that out of this number at least a thousand were Europeans. Quite a number of West Indian laborers have gone to the brush and can no longer be relied upon for steady work, so that the labor force has been depleted.

No new family quarters were erected during the year except at Toro Point. As bachelor quarters along the line became available they were utilized for nonhousekeeping quarters, and at the close of the year 122 families were accommodated in this class of quarters. When the work in the Chagres section of the central division closed in the spring, all laborers and gold employees of that division in the San Pablo and Tabernilla district were transferred to other districts and the houses thus made available were assigned to employees of other districts who were unable to secure family quarters at the points where they work.

The total number of West Indians in laborers' barracks is 200 less than at the close of the preceding year, and of Europeans 1,000 less. Laborers' barracks in the territory extending from Bohio to Mamei inclusive were abandoned and advertised for sale. The camps at Santa Cruz, Cucuracha, and Cartagena were also abandoned and the buildings at Santa Cruz demolished and sold.

To care for the building construction, two additional traveling gangs were formed, one of carpenters and one of painters, and a corresponding reduction of artisans in the various districts was made. Nine buildings and one addition were put up under contract at a total cost of \$44,429.30, nearly all of which were at Toro Point. The contract price on the types of houses erected showed a reduction on contract prices of the previous year. In addition, 29 buildings were taken down in sections and reerected at other points. This work covered buildings of every description. In a greater part of the buildings constructed by the traveling gangs old material and lumber recovered from demolished buildings were utilized. The total number of buildings on June 30, 1911, was 2,985, as compared with 3,078 on June 30, 1910. There was an increase in the number of American buildings and a decrease of 112 in the number of French buildings. During the year 86 buildings were demolished and 109 sold.

The centralization of all storehouses under one head has resulted in more efficient operation in the handling of materials and supplies used for the work; it enables the entire amount of material on hand to be applied to the whole work, which is not the case under separate control by divisions and departments, and the stock that must be kept on hand is therefore reduced. The time has arrived when the surplus material should be worked off so as to leave as small an accumulation when the canal is completed as is consistent with continuous efficient progress of the work. With this in view, surplus stock was concentrated at Mount Hope, Empire, and Gorgona, certain classes of material being localized, so that steam shovel, drill repair parts, and electrical material were concentrated at Empire, and air-brake material, lubricators, injectors, car, locomotive, and other similar repair parts were concentrated at Gorgona. This policy of stock reduction may make it necessary to resort more frequently to emergency purchases than heretofore, but it is in line with ultimate economy.

Besides the regular delivery work and that performed for the sanitary department, teams were used in the construction of the Sweet Water Reservoir at Toro Point; Gatun Reservoir; road work between Pedro Miguel and Corozal; street work at Panama and Colon and on the Obispo diversion. A number of teams and brakes were used by the department of civil administration during the school year. The loss of mules was not as heavy as during the preceding year, as there were no infectious diseases; 54 animals died, or were condemned and sold or destroyed. No mules were purchased during the past two years and no new saddle horses during the past two and one-half years. The majority of the stock has been in service on the Isthmus between four and five years and is beginning to show the effects.

The work performed for the sanitary department has increased, the grass-cutting area having been further extended to include more territory. The removal of garbage has slightly increased. A new incinerator was installed at Gatun in November, 1910, and a road built to it from New Gatun. The amount expended by the quartermaster's department on orders from the sanitary department for Zone sanitation was \$210,403.29 and for hospitals, quarantine, etc., \$77,284.48.

The work of removing French scrap iron and steel and shipping it to the States was continued through the year, and since April 10, 1911, it has been under the direction of the quartermaster's department. From the inception of the work to the end of the fiscal year 28,933 long tons of iron and steel had been shipped and disposed of at an average selling price of \$11.86 per ton. In addition, 231,598 pounds of old screening were shipped and sold at an average selling

price of \$7.75 per hundredweight; 58,689 pounds of rope at an average selling price of \$2.15 per hundredweight; 83,188 pounds of rubber at an average selling price of \$2.01 per hundredweight; and 113,904 pounds of hose at an average selling price of \$2.50 per hundredweight. Advertisements were issued seeking new bids for the sale of all the French scrap on the Isthmus, and if contract is awarded the contractor will do his own scrapping and make his own arrangements for handling and shipping.

The quartermaster's department attends to all purchases on the Isthmus, and the amount expended in such purchases aggregated \$2,440,226.40, of which \$1,547,568.71 were for the purchase of coal from the Panama Railroad Co., \$772,901.22 for the purchase of crude oil from the Union Oil Co., \$103,703.62 for miscellaneous purchases from the Panama Railroad Co., leaving \$15,870.10 for the purchase of miscellaneous supplies from local merchants; the balance was used for postage stamps.

For further details concerning the operation of this department attention is invited to Appendix J.

#### **SUBSISTENCE DEPARTMENT.**

The subsistence department is charged with the operation of the Isthmian Canal Commission hotels, messes, and kitchens, and is in charge of Maj. Eugene T. Wilson, United States Army, as subsistence officer.

At the end of the fiscal year this department was operating the Tivoli Hotel, 19 line hotels, 3 night restaurants, 16 European laborers' messes, and 14 common laborers' kitchens, an increase of 1 hotel and a decrease of 3 messes and 4 kitchens. The supplies are procured from the commissary belonging to the Panama Railroad Co., which is operated by the subsistence officer, who is also commissary for the railroad. The total number of meals served by the hotels was 2,216,740, which was an increase of 40,289 over the previous fiscal year. The cost of supplies per meal was 25.44 cents, or 0.57 cent more than during the previous fiscal year, and the expense in preparing and serving meals was 0.62 cent less, or 5.61 cents, resulting in a decrease in the total cost per meal of 0.05 cent. The total number of rations served in European laborers' messes was 1,054,545, or 37,942 less than last year. The cost of supplies per ration increased 0.16 cent, but the cost of service decreased 0.72 cent, making a decrease in the total cost of a ration of 0.56 cent, or a cost for the year of 36.22 cents. The total number of rations served in the laborers' kitchens was 444,503, a falling off of 337,243 over the previous year. The cost of supplies per ration decreased 0.63 cent and the cost of service decreased 0.60 cent, making the total cost of the ration 26.06 cents.

The total revenue for the year from line hotels, restaurants, messes, and kitchens was \$1,254,262.40, a decrease of \$96,395.65 as compared with last year. The total supplies consumed decreased \$57,660.17 and the total cost of service decreased \$37,980.50, giving a total cost of operations for the year of \$1,221,469.29. As the result of the year's operations the line hotels and restaurants showed a loss of \$20,905.44, the European messes showed a profit of \$39,236.63, and the common laborers' kitchens showed a profit of \$14,461.95.

On November 1, 1910, the room rates at the Hotel Tivoli were reduced approximately 10 per cent. The hotel was operated at a profit which aggregated \$26,427.05. In addition to repairing equipment and replacing such minor dining-room and kitchen equipment as was necessary, new furniture and linen amounting to \$7,000 were purchased to replace such as were no longer serviceable.

For further particulars concerning the operations of the subsistence department, attention is invited to Appendix K.

#### EXAMINATION OF ACCOUNTS AND DISBURSEMENTS.

##### EXAMINER OF ACCOUNTS.

The duties of the examiner of accounts were outlined in detail in the annual report for 1909 and continued unchanged during the past fiscal year. The department was in charge of Mr. W. W. Warwick until May 9, 1911, when he was transferred to Washington for duty as a member of the President's Commission on Economy and Efficiency. The vacancy thus created was filled by the promotion of Mr. H. A. A. Smith on May 12, 1911.

The system of bookkeeping put into effect on July 1, 1909, by which expenditures are classified by divisions and departments, was continued through the year, and the advantage has been clearly shown by the results obtained. The number of bills rendered against employees and other individuals and companies has been gradually reduced by improved methods of collection. The past year showed a considerable decrease in the monthly average of bills rendered, though the volume of business done has materially increased. The accounts of all bonded employees charged with the collection of revenues due the commission were audited and balanced each month.

The accounting for the issuing of commissary and hotel coupon books and meal tickets for colored and European laborers and the operation of hotels, messes, and kitchens involves considerable detail in examining and settling the accounts of issuing clerks and stewards. For the past three years coupon books and meal tickets have been issued by the disbursing officer on requisition of bonded employees after approval by the examiner of accounts, and the method has worked successfully. A saving was effected during the year by the

adoption of uniform meal tickets of 30 and 40 cent denominations, without the department or division designation, which previously existed. During the fiscal year 520,000 coupon books and 1,428,000 meal tickets were issued. The proposition for the sale of coupon books for cash instead of by the existing system of deductions on pay rolls is under consideration.

An improvement has been made in handling claims, principally by the consolidation of smaller accounts into one and the rendition of a monthly claim rather than smaller ones during the same period. Claims aggregating \$10,077,000 were audited and paid. At the close of the fiscal year unpaid claims on hand amounted to \$454,000.

The required administrative examination of the disbursing officer's account was made monthly. A careful permanent record is maintained of all unpaid salaries and wages due employees of the commission, and this record is gradually increasing. In the majority of cases the amounts due employees who have left the work are small, and claims are frequently presented for salaries and wages earned from one to six years earlier. The unpaid salaries and wages amounted on June 30, 1911, to \$217,081.86.

The work of the pay-roll division consists of a detailed examination and verification of all pay rolls of the commission and of the government of the Canal Zone where payments of salaries and wages are made from appropriations by Congress. The examination of the pay rolls is not confined to the correctness of calculations relating to time and amounts, but also of a careful detailed check against the personnel records of all gold employees and a verification of deductions made on account of funds due the Government for commissary and hotel coupon books, meal tickets, transportation, lost tools, metal checks, hospital and corral bills, and other miscellaneous collections. This work occupies only a portion of the month's time, and after it is completed for any one month the force engaged on that work is detailed to various time-keeping offices of the several departments and divisions to check the time books against the pay rolls as a verification of the payments made and to see that all time is properly kept in accordance with existing rules and regulations. The supervision and direction of time keeping and questions relating thereto was placed under the examiner of accounts. The effect has been a more uniform method among all departments and divisions of handling questions relating to time keeping, as is manifested by the greatly improved form in which the pay rolls are submitted for examination.

The inspection of the accounts of all bonded employees who are charged with the receipt or disbursement of public funds and the issue of coupon books and meal tickets was continued during the year with a force of three inspectors, a reduction of one formerly engaged on this work. The financial accounts consist of records of

cash transactions in tax collectors' offices, post offices, clubhouses, hospitals, hotels, disbursing offices, water rents, courts, and collectors of revenues. Monthly accounts are rendered by all financially responsible employees, and the accounts are audited and balanced at the close of each monthly period.

The work of time inspection has increased because of the field covered, which has gradually grown larger; the extension of night and Sunday work, and also because its scope was extended to cover special investigations. An average of 29 men were engaged on this work, in addition to 5 senior inspectors located at Ancon, Culebra, Gorgona, Gatun, and Cristobal. On May 1, 1911, the number of senior inspectors was reduced to four and the districts rearranged to meet changed conditions, with headquarters at Ancon, Empire, Gatun, and Cristobal. The average number of inspections made daily was 11,368, in addition to which there were 3,000 special reports necessitating investigations.

The cash balance in the hands of the disbursing officer was verified and a detailed count made on December 31, 1910, and May 31, 1911. In addition, the transfer of cash was witnessed and verified on September 1, 1910, when the disbursing officer turned over his cash to his assistant prior to entering on his leave, and again verified when the same was retransferred upon the return of the disbursing officer October 30, 1910.

Under the existing agreement with the Republic of Panama whereby the United States is to construct and maintain waterworks, and be reimbursed for these expenditures at the expiration of the 50-year period, with interest at  $2\frac{1}{2}$  per cent per annum, there had been expended on June 30, 1911, \$1,461,303.31 in the city of Panama and \$1,225,922.50 in the city of Colon. The Republic of Panama has been credited with the sum of \$568,690.45, leaving a balance still to be paid of \$2,118,535.36. Of the amount credited, \$22,420.63 represents the water rentals paid by the commission and Panama Railroad Co. in the cities of Panama and Colon and \$546,269.82 represents the actual collections for water rentals made by the superintendent of public works.

The examiner of accounts also handles the claims that arise under the employer's liability act, and during the year adjusted 1,619 claims which developed from 1,573 injuries and 112 deaths. The sundry civil appropriation act of March 4, 1911, section 5, extended the provisions of the injury compensation law to all employees under the commission who are injured or killed in the course of their employment without negligence or misconduct on their part, and provided that the claims shall be settled by the chairman of the Isthmian Canal Commission. The result has been that settlements

are made in considerably less time, as it was necessary formerly to submit the claims to the Secretary of Commerce and Labor at Washington for settlement.

The examiner of accounts is also auditor for the Canal Zone Government. The accounts of all fiscal officers of the Government of the Canal Zone are audited and balanced each month. The work involved the examination of 552 monthly accounts. The funds of the treasurer were maintained in two banks in Washington and in one depository on the Isthmus. The average monthly balance at Washington has been \$981,620.75 and that on the Isthmus \$43,239.99, from which a revenue amounting to \$27,763.40 on account of interest was received.

For further particulars, attention is invited to Appendix L.

#### DISBURSEMENTS.

The work of this department embraces the securing of and disbursing the necessary funds and the accounting for all moneys paid out or collected, as well as the issuance of hotel and commissary books and meal tickets to the various departments of the commission. It is in charge of Mr. E. J. Williams, disbursing officer.

The pay-car schedule, which formerly provided four days to effect the payment of the forces on the Isthmus, was reduced to three in April. The total amount paid out by the disbursing officer on pay rolls aggregated \$19,415,987.02, in addition to which \$10,017,600.13 were paid out in settlement of public bills and on reimbursement vouchers. The value of hotel books, commissary books, and meal tickets issued totaled \$4,150,943.50.

For further details, attention is invited to Appendix M.

#### DEPARTMENTS OF CIVIL ADMINISTRATION AND LAW.

##### CIVIL ADMINISTRATION.

The organization of the department of civil administration remained substantially as described in former annual reports. It was in charge of Mr. Maurice H. Thatcher, as head of the department.

The only congressional legislation affecting the Canal Zone during the past year, other than the change in the employer's liability act already noted, was the act approved June 25, 1910—"To further regulate interstate and foreign commerce by prohibiting transportation therein for immoral purposes of women and girls, and for other purposes."

Fifteen Executive orders of the President and Secretary of War having the effect of law were issued. The more important of these are the order of July 25, 1910, authorizing the Isthmian Canal Com-

mission to establish rules and regulations to facilitate and protect canal work; the order of July 28, 1910, prescribing the jurisdiction of Canal Zone courts in civil cases where both defendant and plaintiff are nonresidents of the Canal Zone; the order of August 20, 1910, respecting the conveyance of real estate by married women; the order of February 2, 1911, providing a method of executing and recording deeds; the order of May 6, 1911, respecting the arrest and discharge of deserting seamen; the order of May 13, 1911, providing for the collection of a distillation tax in the Canal Zone.

Eight ordinances were enacted by the Isthmian Canal Commission and approved by the Secretary of War, under the provisions of section 7 of the Executive order of the President dated March 13, 1907, relating principally to licensing automobiles, chauffeurs, and bicycles; to fixing rates for coach hire; and to keeping the watersheds free from contamination.

Some of the matters taken up with the officials of the Republic of Panama and satisfactorily adjusted are a modification of the agreement by which the Republic of Panama was permitted to increase the import taxes on certain articles from 10 to 15 per cent; the charging of consular fees by consuls of the Republic of Panama for the certification of documents covering shipments consigned to the commission and the Panama Railroad Co.; the withdrawal from entry by the Republic of Panama of lands situated in the Republic which will ultimately be covered by the waters of Gatun Lake; the conveyance in certain cases of American citizens in the city of Panama in need of medical attention to Ancon Hospital for treatment; fire protection in the cities of Panama and Colon; the construction of roads in the Canal Zone and the continuation thereof in the Republic of Panama; the enforcement of laws prohibiting the recruiting of labor on the Isthmus; the adoption of uniform coach rates for the Canal Zone and the cities of Panama and Colon; the adoption of uniform laws providing for the collection of distillation taxes in the Republic of Panama and in the Canal Zone; public improvements in the cities of Panama and Colon; the suppression of white-slave traffic through Panamanian ports and in the cities of Panama and Colon; and the revision of the contracts between the Republic of Panama and the Isthmian Canal Commission for the amortization of the cost of the waterworks, sewer system, and paving in the cities of Panama and Colon. The relations of the commission with the Republic of Panama and with foreign representatives continue satisfactory.

*Steamboat-inspection service.*—During the year the board of local inspectors issued 56 licenses to pilots; 7 to masters, 4 of which were issued as joint master-pilot licenses; 12 to mates; and 11 to engineers. Rules for the navigation of the Panama Canal and all waters



under the jurisdiction of the commission were drafted by the board, adopted by the commission on December 5, 1910, and approved by the Secretary of War December 21, 1910. The duties of the board were extended, with the approval of the Secretary of War, to include the general inspection of all floating plant of the commission and the Panama Railroad. This board is also to examine and license chauffeurs of automobiles, in accordance with an ordinance enacted by the commission on April 15, 1911, and approved by the Secretary of War on April 26, 1911.

*Posts, customs, and revenues.*—The postage sales for the fiscal year amounted to \$82,893.72, a decrease of \$953.38 as compared with the preceding year. During the same period 141,225 registered letters and parcels were handled, of which approximately 48 per cent was official matter. Money orders to the number of 214,780 were issued for a total of \$5,304,906.60 in value, on which fees aggregating \$23,455.09 were collected. The money orders sold during the year exceed the sales during the year ended June 30, 1910, by \$76,344.45. There were in the post offices of the Canal Zone on June 30, 1911, unpaid money orders aggregating \$332,141.60 drawn to the order of the remitter and payable at the office of issue, indicating the extent to which the post offices are used as depositories by the employees. A convention providing for the direct exchange of money orders between the Canal Zone and the Republic of Costa Rica was concluded and became effective April 1, 1911. Effective January 9, 1911, a post office, officially designated as Station B, Cristobal post office, was established at Toro Point. An agreement was entered into between the postal systems of the Canal Zone and the United States for the reciprocal payment of indemnity for the value, up to \$25, for the loss or rifling of domestic registered matter of the third and fourth classes, and up to \$50 for domestic registered matter of the first class, to become effective July 1, 1911. The postal service has also been authorized to pay an indemnity of 50 francs, regardless of value, for the loss of registered articles between the Canal Zone and the Postal Union.

During the year 264 vessels entered the port of Ancon, with a tonnage of 457,746, and 263 vessels cleared with a tonnage of 454,572. At Cristobal 263 vessels entered with a tonnage of 722,870, and 264 vessels cleared with a tonnage of 727,955. Under the agreement with Panama, no duties, tolls, or customs fees were collected.

On June 30, 1911, there were in force 2,251 leases, of which 984 were for building lots and 1,261 for agricultural lands, a decrease of 530 in the number of leases as compared with the previous year, due largely to the cancellation of leases in the Miraflores and Gatun Lake areas. The leases for agricultural lands covered 1,430 hec-

tares, or approximately 3,534 acres. Rents collected amounted to \$23,469.22.

A total of \$123,876 was collected on account of general taxes and licenses. Of this amount \$2,353.88 were for distillation taxes, \$68,400 for licenses for the sale of liquor at retail, \$512.59 for license fees from insurance companies doing business in the Canal Zone, and \$1,057 received for 38 licenses for motor vehicles in the Canal Zone.

During the year 43 estates were settled, and on June 30, 1911, 8 were in course of settlement. The money handled on account of the administration of estates aggregated \$4,748.46.

*Police and prisons.*—The police force consisted on June 30, 1911, of a chief and assistant chief, 5 clerks, 2 inspectors, 4 lieutenants, 8 sergeants, 20 corporals, 117 first-class white police officers, and 116 colored officers.

Arrests during the year aggregated 5,959, of which 5,500 were of males and 459 of females. Of the total number of persons arrested 80 per cent were convicted. On June 30, 1911, there were 148 convicts confined in the penitentiary at Culebra, who have been kept at work on public roads, and the value of the work performed on the basis of 10 cents an hour for each convict was \$25,348.80. The cost of guarding, subsisting, and clothing the convicts was \$30,788.05, of which \$4,941.42 represented the increased cost of guarding convicts when engaged on work on the public roads. Misdemeanor prisoners were also used in public improvements wherever practicable, especially on road and street maintenance. The total value of labor performed by this class of prisoners during the year, on the basis of 10 cents per prisoner per hour, was \$22,329.40, of which \$9,377 represents labor on public improvements and \$12,952.40 represents janitor service in public buildings. Amended regulations were prescribed for the government of convicts in the penitentiary and five grades were established, three for the outside and two for the inside. Good-conduct points are given on the basis of which transfers are made to higher grades, involving a change in the clothing and the removal of the ball and chain when engaged on outside work.

Deportations of undesirable characters from the Canal Zone aggregated 111 persons. Two pardons were granted and three sentences were commuted.

*Fire protection.*—The organization of this division consists of 1 chief; 1 assistant chief; 1 clerk; 1 messenger; 7 captains; 7 lieutenants; 41 firemen; 1 engineer; 1 electrician; and 1 lineman, constituting the paid fire force. Two volunteer companies were disbanded as no longer necessary. A new volunteer company was organized at Toro Point.

A new fire station was constructed and opened for service at Mount Hope. At Gatun, a one-story building was constructed on the west

side of the locks to provide quarters for paid firemen. A new site was selected for the station at Cristobal, which must be moved because of the construction of the new wharves. It is to be a two-story concrete building 75 feet long by 55 feet wide. The station at Culebra was moved to a new site on account of the slides at that locality.

There were 252 alarms of fire responded to during the year, 14 of which were false. Of the 238 fires, 1 was in the city of Panama and 8 in the city of Colon; 147 were in Government property and 36 in property of the Panama Railroad Co. The value of Government and Panama Railroad property involved, as reported by the fire chief, was \$2,162,938.31. The total loss was estimated at \$17,433.42 for Government property and \$5,123.07 for property of the Panama Railroad Co. The largest fire originated in the city of Colon on March 23, 1911, resulting in a property loss to the commission of \$14,394.93.

*Public works.*—The organization of this division consists of 1 superintendent; 1 assistant superintendent; 6 clerks; 1 inspector and messenger; 2 inspectors of plumbing; 1 inspector of meters; 1 market inspector; 3 engineers; 6 foremen; 11 masons; 12 pipefitters; 10 laborers; and 1 carpenter.

In the city of Panama there were 1,809 connections made with the water mains and sewers and 42 applications pending. The collections of water rents from private consumers for the first three quarters of the year in the city of Panama were \$57,693.45, and bills rendered for the last quarter aggregated \$20,913, or a total for the year of \$78,606.45. The Republic of Panama was required to pay \$4,316.06 in order to liquidate the proportionate part of the cost of the water, sewer, and street systems for the year.

In the city of Colon there were 559 connections made during the year and 64 applications for connections pending. Collections in Colon from private consumers and from the commission and Panama Railroad Co. during the first three quarters were \$57,818.80, and the net amount of bills rendered for the fourth quarter was \$18,614.30, or a total for the year of \$76,433.10. The Republic of Panama was required to pay \$2,748.83 in order to liquidate the proportionate part of the capital cost of the water, sewer, and street systems due for the year.

On September 30, 1910, new agreements or contracts were entered into with Panama providing for a quarterly adjustment of all payments due by the Republic under the plan of amortization of the cost of the water, sewer, and street systems in the two cities. Under the new agreements the total amount due from the Republic to the United States is taken as the capital cost at that time. One-fourth of the capital cost due at the close of each quarter is taken as the

installment of such capital cost to be paid as of that date, and added thereto is interest on the capital cost for the quarter, together with the quarter's charges for maintenance and operation. Applied to the payment of these items is the total amount collected on account of water rents during the quarter. If a difference remains in favor of the United States, the Republic of Panama pays it; but if the difference is in favor of the Republic of Panama, the amount is credited to the capital cost due.

In the Canal Zone 615 connections were made during the year. From the nine public markets in operation during the year a revenue of \$4,786.67 was derived from the rental of space.

*Schools.*—The organization in this division consists of 1 superintendent, 2 clerks, 1 supervisor of upper grades, 1 supervisor of primary grades, 2 supervisors of children, 1 principal of high school, 5 principals of grammar schools, 61 teachers, and 1 gardener temporarily employed.

When the school year opened on October 1, 1910, there was an enrollment of 1,837 children, 931 in the white and 906 in the colored schools. The highest monthly enrollment was in June, when 1,410 pupils were enrolled in the white schools and 1,568 in the colored schools. Early in the school year the schools at Colon Beach, Las Cascadas, and Corozal were consolidated with those at Cristobal, Empire, and Ancon, respectively. Pupils are carried to and from the schools either over the Panama Railroad or by a system of brakes or carryalls. The number of schools in operation throughout the year was 10 for white children and 15 for colored children. One additional white and two additional colored schools were in operation for part of the year. The Canal Zone high school was transferred from Cristobal to Gatun, and a branch high school was established in the school building at Ancon. On June 30, 1911, there were 11 schools for white children and 16 for colored children.

*Courts.*—The supreme court held 16 sessions during the year. It affirmed the decision of the circuit court in 3 criminal cases and reversed the decision of that court in 2 criminal cases. At the beginning of the year 6 civil cases were pending, 9 were filed, and 11 were disposed of. In the circuit courts 374 criminal cases were filed; 234 convictions were secured and 78 acquittals; 43 cases were dismissed, and 19 cases were pending at the close of the fiscal year. There were 339 civil cases filed during the year, 231 of which were disposed of, and 108 were pending at the end of the year. In the district courts 5,862 criminal cases were filed; 4,464 convictions secured, 847 acquittals; 243 cases were dismissed; 304 were appealed to the circuit courts, and 4 cases were pending on June 30, 1911. During the year 948 civil cases were filed, 918 were disposed of, and 30 were pending at the end of the year.

*Canal Zone funds.*—At the beginning of the fiscal year there were \$73,181.79 on hand in the Zone treasury, and \$426,963.33 were collected during the year. The expenditures amounted to \$280,013.15 for public improvements, schools, maintenance of administrative districts, and contingent expenses in the postal service.

For further particulars concerning the work in this department, attention is invited to Appendix N.

#### DEPARTMENT OF LAW.

By an Executive order of the President dated April 16, 1910, the position of counsel and chief attorney was created with specific duties and filled by the appointment of Judge Frank Feuille. Under the order he is the legal adviser to the commission, the chairman, and the head of the department of civil administration; in addition, he has the direction and control of all litigation, as well as the supervision and direction of all prosecutions for offenses against the law. The Executive order of January 8, 1908, created a department of law, which was charged with the general supervision of legal matters pertaining to the commission, including the acquisition of right of way and the adjustment of land damages. Under this order, land questions were handled through the prosecuting attorney on the Isthmus by the general counsel located in Washington. After the resignation of the general counsel on April 30, 1909, only such land matters were considered by the prosecuting attorney as needed immediate attention. Land titles on the Isthmus are in an unsettled state, and with the completion of the canal construction in sight it became necessary to adopt some measures looking to the adjustment of the land situation as soon as possible. It was decided, therefore, that all questions affecting lands on the Isthmus should be handled by the counsel and chief attorney, and with this in view, with the approval of the Secretary of War, the department of law as established in 1908 was placed under the direction of the counsel and chief attorney.

Questions affecting lands belonging to the Panama Railroad were handled by the land office of that organization, and those affecting lands owned by the commission were handled by the legal department; and though the counsel and chief attorney is also the attorney for the railroad, it was deemed advisable to consolidate all land matters on the Isthmus. This was effected on May 1, 1911, under the Executive order of January 19, 1911, by the creation of a land office, to which were transferred all papers, maps, records, and other documents relating to lands owned or controlled by the United States in the Canal Zone and the lands auxiliary to the canal. The land office will be operated by the commission, the Panama Railroad Co. paying its share of the expenses under an agreement entered into by the two interests.

The act of Congress approved February 27, 1909, relating to the use, control, and ownership of lands in the Canal Zone, authorizes the President to lease the land as he may deem proper and convenient. No leases have been made under this act, but a practice of issuing leases by authority of the Secretary of War was adopted and continued until recently. By the Executive order of October 7, 1910, such leases are to be executed by the officer in charge of the land office, with the approval of the head of the department of civil administration.

From August 6, 1908, until June 30, 1910, 11 joint commission awards were paid by the Government for lands taken over for canal purposes, amounting in the aggregate to \$142,515, and the joint commission having failed to agree in three claims, they were settled in accordance with the findings of the umpire for \$61,000. During the same period 16 tracts of land were acquired by the United States for canal purposes under private agreements with the owners for \$47,215.74, and 50 claims for damages to crops and improvements were settled for \$5,037.95. In addition, 68 claims were paid between April 8, 1910, and June 30 following on account of the fire at Nombre de Dios for \$8,796.55.

During the year the island of Margarita in Manzanillo Bay near Colon and one or two other small holdings involving titles to lands were acquired by the payment of \$4,250. In addition, 112 claims for damages arising in connection with excavation work, surveys, road building, and other canal activities were settled for the sum of \$4,532.37. Ten additional claims for the fire at Nombre de Dios were settled for \$436.20. There were 208 claims in the area of Lake Gatun, including the valleys of the Chagres, Gatun, and Trinidad Rivers, adjusted and paid for \$46,704.50. The sum of \$33,964.85 was paid to the Caribbean Cocoanut Co. by the Panama Railroad Co. on account of damages resulting from the cancellation of a lease held by them at Toro Point. The total amount paid on claims during the fiscal year was \$90,442.92.

The Executive order outlining the duties of the counsel and chief attorney gives to the latter equal authority with the judges of the courts of the Canal Zone to issue subpoenas for witnesses in criminal cases and to examine witnesses under oath in the investigation of offenses against the laws of the Canal Zone. Information in a civil case may also be filed by the prosecuting attorney, the assistant prosecuting attorney, or other counsel specially designated by the head of the department of civil administration, as well as by the counsel and chief attorney. This order contained substantial modification of the then existing law, providing a more expeditious method of prosecuting criminal cases.

Conflicts between agents of the commission engaged in canal construction and shipping interests began to arise relative to the rights of parties to the use of canal waters. This resulted in the enactment of legislation to prevent interference with canal construction, authorizing the commission to establish rules and regulations respecting the use or passage through the canal channel and all other navigable waters, and to fully protect such navigable channels from injury or obstruction.

During the existence of the municipal governments in the Zone taxes were assessed, levied, and collected by the municipal authorities for the benefit of the local treasuries. The municipal governments were abolished by Executive order effective April 15, 1907, and the functions of the municipal officers were vested in the district tax collectors, under the supervision of the collector of revenues. Confusion resulted as to right of forfeiture of property to the Canal Zone government in default of bidders at tax sales. To remedy existing conditions, the Executive order of October 4, 1910, abolished the office of district tax collector, and the powers and duties of this office were vested in the collector of revenues, to be exercised by him through deputies. The order also provided that property sold for taxes should be forfeited to the Zone government in default of bidders at tax sales.

The counsel and chief attorney calls attention to the necessity of compiling, revising, and adding to existing legislation so as to establish a simple, complete, correlated, and efficient system for the civil government of the Canal Zone. The administrative laws are also in need of revision, so that the duties of the various departments may be clearly defined and coordinated. The law of civil procedure, the criminal code, and the law of criminal procedure also need revision. These matters, however, while important, are held in abeyance until the policy of the United States with reference to the Canal Zone is determined.

Attention is invited to these matters and to the suggestions and recommendations of the counsel and chief attorney; they will be found in Appendix O herewith.

#### DEPARTMENT OF SANITATION.

The work of this department embraces sanitary work in the cities of Colon and Panama, and, except oiling, it designates the sanitary work to be done in the Canal Zone in order to accomplish the desired ends, exercising such supervision as is necessary to see that the work is satisfactorily performed. In addition, the department has charge of hospitals and quarantine. The department is in charge of Col. W. C. Gorgas, United States Army, as chief sanitary officer.

The work in the terminal cities consists of cutting grass and brush, oiling pools, and constructing and maintaining ditches for drainage purposes, removal of garbage and night soil, fumigation, and street cleaning. On account of the juxtaposition of Cristobal and Mount Hope to Colon, these are included in the Colon area, and for the same reason Ancon Hospital grounds are incorporated with Panama.

In the Canal Zone the quartermaster's department expended under the direction of the sanitary department in and about commission settlements \$114,725.98 for grass and brush cutting, and \$42,184.35 for the removal of night soil and garbage. The amount expended for the removal of garbage and night soil in native settlements was \$22,615.03. In the maintenance of existing ditches and the construction of new ones for drainage purposes the construction divisions expended a total of \$81,407.93; the new work was done in accordance with plans prepared by the sanitary department. The sanitary department expended \$11,708.08 for oil and \$16,756.17 for its distribution, and \$16,711.85 for larvacide and \$13,489.74 for its distribution, or a total of \$58,665.84; in addition \$99,241.19 were expended by it for sanitary work in the terminal cities.

In reporting on the health condition on the Isthmus, the chief sanitary officer states that the total admissions to hospitals and sick camps, including those sick in quarters, netted for the year 53,534; that the daily average of sick was 24.77 out of every 1,000 employed as against 23.01 for 1909-10, and 23.49 for 1908-9, on the basis that the total number employed during the years mentioned were 49,129, 50,535, and 44,261, respectively; that the total number of deaths among employees was 557, of which 33 were Americans, 96 were white employees of other nationalities, and 428 were blacks; that the number of deaths from violence among all employees was 178 as against 174 for the preceding year; and that in addition to the number of deaths reported 134 deportations were made, 104 for disease and 30 for injuries.

For further details concerning this department attention is invited to Appendix P.

#### RECREATION FOR EMPLOYEES.

On June 30, 1911, there were seven clubhouses in operation. A small recreation hall which was constructed at Corozal and operated under the management of the employees was enlarged and turned over on January 24 to the supervision of the Young Men's Christian Association. Additions were made to clubhouse buildings at Empire and Cristobal and an additional bowling alley installed in each. These additions, including the alleys, were paid for from the Young Men's Christian Association funds at a cost of \$4,762.80. Additional equipment, consisting of phonographs, umbrella racks, library books,



bowling and pool equipment, and vibrators for the barber shops, were added from time to time as the need became evident. The average monthly membership for the year was 1,947, as against 1,264 for the previous year. The smallest membership for any month was 1,712, for July, 1910, and the largest was 2,121, for January, 1911. The total expenditures from commission funds for the support of these clubhouses aggregated \$60,488.46, of which \$51,193.90 was for operation of clubhouses and \$9,294.56 for equipment for new clubhouses at Gatun and Corozal.

Further details of the operations of the clubhouses are given in Appendix Q.

#### WASHINGTON OFFICE.

The work of the Washington office was of the same scope as reported for the preceding year and continued in charge of Maj. F. C. Boggs, United States Army.

During the year 1,706 persons within the United States were tendered employment on the Isthmus in grades above that of laborer, and 1,083 accepted and were appointed, covering 58 different positions.

The total amount of purchase orders placed during the year was \$6,976,066.59. The most important contracts placed were for six emergency dams for the canal locks, amounting to \$2,238,988.40, and for the machinery and materials entering into the construction and operation of the locks, amounting approximately to \$2,456,482.23. The other principal items purchased were: One twin-screw steel ladder dredge with a hopper capacity of 1,200 tons of spoil, 2 locomotive cranes, 1 electric trolley crane, 12 concrete mixers, 2 narrow-gauge locomotives, 1 unloader plow, 19,577,589 feet of lumber, 3,400 tons of steel rails, 2,775 piles, and 8,000 frames for concrete piles.

During the year three independent inspecting offices were established for the inspection of the lock gates and materials which enter into the construction of the locks and movable dams.

For further details attention is invited to Appendix R.

#### SUGGESTIONS AND RECOMMENDATIONS.

The estimated date for the completion of the canal was based on the report of the international board of engineers submitted in 1906, and was fixed at January 1, 1915. In the meantime, the work advanced more rapidly than had been anticipated, and it became apparent that it would be possible to pass vessels through the canal at least a year earlier than this date. Becoming aware of this contingency and realizing the necessity for commerce to adjust itself to the new conditions, the shipping interests of the world raised the question of canal tolls in July, 1910, and urged an early settlement.

Attention was called to the fact that at least 18 months' notice of the rates should be given in order that steps might be taken in time to change routings that would follow if the canal were used. If rates are such as to warrant the adoption of the new route, commerce will adjust itself to its utilization as soon as possible; if not, the old channels will continue to be followed. Inquiry not only confirmed this statement, but developed the fact that the organization of new companies for use of the canal was contemplated, provided the established rates should be sufficiently attractive. It was developed, also, that two years' advance notice was desired in order to permit the building of the necessary ships.

It is of course desirable to put the canal in use as early as possible, not only to secure a financial return but also to have everything in good running order, so as to insure the passage of the fleets of the world for which Congress has made provision, without confusion or delay.

To determine, then, the approximate date when the canal would be ready for use, and to report what steps, if any, should be taken to expedite the work, a board was convened, composed of those charged with the work in progress and contemplated. Based upon the report of this board, announcement was made that all the concrete in the locks at Gatun would be laid by June 1, 1912, and in the locks on the Pacific side by October 1, 1912; that, assuming the gates were completed by June 1, 1913, as stipulated by the contract, the locks would be ready for use on this date if the operating machinery were installed; that the work on the spillway at Gatun would be completed to the elevation of 50 feet by April 1, 1912, and the entire dam would be finished by the close of the dry season of 1912-13; that the excavation through Culebra Cut would be completed by July 1, 1913, if no more material due to slides had to be removed than was estimated at that time; and that the exterior channels would be sufficiently advanced to pass the shipping that would use the canal.

It was desirable, therefore, that legislation should be provided without delay for the establishment of tolls, and should be sufficiently flexible to permit of ready change should conditions arise to warrant it. After the enactment of the necessary legislation, and before fixing the rate, data should be prepared showing the amount of traffic that might be expected, upon which to base the rate, and rules for measuring ships should be formulated so as to determine the charges to be made for various vessels.

A year has elapsed since the report upon which the statements heretofore made were based, and though an increase due to slides was made in the estimated amount of material to be removed from the Culebra Cut, this increase gives no grounds for changing the date; moreover, after the completion of the locks, dredges can be

passed into the cut and the remaining material can be removed more economically and to better advantage. Though the division engineer can not complete all the concrete work on the Gatun Locks by the time first estimated, and now fixes the date as January 1, 1913, this will not interfere with the erection of the gates (the concrete needed for this purpose being practically in place) nor cause any delay to the work as a whole. Progress made in the construction of the dam confirms the promise of its completion. The division engineer adheres to the date heretofore announced for completing the locks on the Pacific side. The erection of the gates has not progressed as contemplated by the contract, but the shopwork is well advanced and by increasing the erecting force there should be no delay on this account. The assistant chief engineer has taken all steps necessary to insure the delivery and erection of the operating machinery and lighthouses, and anticipates completing them on time. The contract recently made for the emergency dams calls for completion of the last one by June 15, 1913.

The need for legislation looking toward the fixing of tolls is therefore urgent. Time can be saved in making public announcement of the rates to be charged by compiling, in advance of legislative action, the data of the amount of traffic that will probably use the canal and the formulation of rules by which the tonnage of ships is to be determined. Steps to this end have been taken.

Another matter needing attention is the organization for the operation of the canal and for the government of the Canal Zone. These two are intimately connected. Existing law provides for the construction of the canal; also for the exercise of the military, civil, and judicial powers necessary for the government of the Canal Zone during a period which has already elapsed.

As the work nears completion, it is intended to concentrate the construction until what remains will be in immediate charge of the directing office, thereby reducing the costs and, so far as possible, the overhead charges. It is believed that a more satisfactory operating force can be secured by the selection of suitable men from the present organization. There has been considerable criticism because of the high wage scale that exists, but this is due to the fact that it was difficult to obtain men when the work started, on account of the bad reputation of the country, and also because of the temporary character of the work. Complaints are made constantly because the salaries are disproportionate to responsibilities, and because of the lack of uniformity in the percentage of excess over the wage scale for similar labor in the States. After the inauguration of the scale it was not considered advisable to make any reduction, and rearrangements were made from time to time as necessities required, but inequalities still exist. Conditions are different now. The chief sani-

tary officer declares the death rate of the Zone to be "much lower than that for most parts of the United States," and the general health of about 8,000 white Americans in the Zone to be "fully as good as it was in the United States"; also, continuance in employment can be assured. It is believed that a lower wage scale can be put into effect for operating the canal, and that the necessary force can be secured from the men who will remain in the service during the next year or two. This is an important consideration, since it is essential that the cost of operation shall be reduced to a minimum consistent with efficiency. With the operating organization provided for, steps can be taken to adopt a salary and wage scale, after which there can be created from the construction force one for operation, without delay or confusion.

The total outlay for maintaining the canal will be for wages of the force engaged in its operation, the expense of engineering work connected therewith, and the cost of sanitation and civil administration. It is difficult to foresee the uses to which the land in the Zone may be put. There are, all told, within the limits of the Zone 436 square miles, of which about 73 square miles are in private ownership and 363 square miles owned by the Government (i. e., either by the commission or the Panama Railroad Co.); of the latter, 96 square miles are occupied by the canal. A large part of the Government land will be required for military and naval purposes, and it is not unlikely that additional lands will be required by other departments of the Government. The position of the Republic of Panama and its two cities with respect to the Zone makes it necessary in the interest of harmony that the Spanish laws now in force shall obtain. The rules and regulations for the government of the Zone, made effective subsequent to the Fifty-eighth Congress, should be approved and changes should be authorized to meet new conditions as they arise.

Under existing law, lands may be leased for a period not exceeding 25 years, with the understanding that the cost of all improvements shall be reimbursed to the lessee in case the lands are needed for other purposes. It is generally the rule that land taken for governmental purposes is never sufficient and must always be extended, and from experience gained in the prices agreed upon for lands taken for canal purposes, the improvements are always expensive. For the most part, the configuration of the ground is not suitable for extensive farming; material obstacles tend to hinder agricultural development; a perpetual title can not be assured; and the Spanish system of taxation must be continued to avoid friction on account of unfair competition with the Panamans. The inducements offered are not likely to attract Americans. Other occupants are not desirable. The town sites already established are populated by laborers, a class which should be repatriated after work can no longer be given them, and

the growth of such towns should be discouraged. The greater the amount of land leased and the number of town sites established and occupied, the greater will be the cost of sanitation and civil government. For several years to come at least, it is believed that the best policy will be to keep all Government lands for Government purposes. Whatever military force is located on the Isthmus will be charged with its own sanitation. The reservation of all lands for governmental use would result, therefore, in minimum costs for these two items.

The Canal Zone occupies a unique position among the outlying possessions of the United States, and on this account requires special treatment. The construction of the canal is the original purpose for which it was obtained, and to this purpose everything within the Zone is made subordinate. In the same way, after its completion everything must be subordinated to the operation of the canal. Assuming that the canal is being built for the benefit of the commerce of the world, it nevertheless is a military asset to the United States and conditions may arise in which the military necessities of the Nation will become paramount. It is essential, therefore, that an entity should be established or created and so organized that any contingency can be promptly met as soon as it arises. In other words, while during certain periods the operation of the canal is for commercial purposes, entirely separate and distinct from the military, there are times when the military necessities must predominate.

Every known precaution has been taken to insure the safety of the locks. Accidents to locks have in nearly every case resulted from misunderstood signals in the engine room. To avoid any possibility of accident which might render the canal useless, the authorities should assume charge of all vessels during their transit of the locks; under such conditions any damage that may result to the vessels should be assumed by the Government, and legislation looking to this end is necessary.

The revenues of the canal should go to pay not only the operating expenses, but to repay the capital invested. Every legitimate means for increasing the revenue should therefore be adopted. The Government should have coal and fuel oil on hand for its own vessels, and these commodities should be sold to shipping using the canal. These should be supplied at an established rate and purchased after advertisement. The existing commissary, manufacturing plant, and laundry should be continued for the benefit of Government forces and to furnish supplies and service to shipping. A wireless telegraph station should be established for commercial as well as military purposes. The canal authorities should be authorized to sell tools and appliances needed by ships, and to make repairs as may be necessary while ships are in the vicinity of the canal. A dry dock

should be built with dimensions conforming to the locks. Both the dry dock and machine shops would be available for use by the Navy. If this policy is to be adopted, early legislation is needed in order that the construction necessary to make it effective may be undertaken without delay.

The organization in effect July 1, 1911, is given in Appendix S; and Appendix T, containing treaties and acts of Congress relating to the canal, has been inserted for purpose of record and convenient reference.

Respectfully submitted.

GEO. W. GOETHALS,  
*Colonel, Corps of Engineers, U. S. Army,*  
*Chairman and Chief Engineer.*

The Hon. HENRY L. STIMSON,  
*Secretary of War, Washington, D. C.*



## APPENDIX A.

### REPORT OF COL. H. F. HODGES, CORPS OF ENGINEERS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, ASSISTANT CHIEF ENGINEER, IN CHARGE OF THE FIRST DIVISION OF THE OFFICE OF THE CHIEF ENGINEER.

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ISTHMIAN CANAL COMMISSION,  
OFFICE OF THE CHIEF ENGINEER, FIRST DIVISION,  
*Culebra, Canal Zone, July 27, 1911.*

SIR: I have the honor to make the following report of the operations during the fiscal year ending June 30, 1911, of the first division of the office of the chief engineer:

This division is charged with the design of the locks, dams, regulating works, and accessories; with the design and construction of aids to navigation, and with the erection of the operating machinery at the locks and spillways. In addition, it is responsible for the inspection of the manufacture and of the erection, under contract or otherwise, of certain of the structures and machines designed in its different subdivisions.

The organization has changed during the year by the addition of a subdivision in charge of the design and construction of aids to navigation, and by the loss of the subdivision, under Mr. T. B. Monniche, charged with the design of the emergency dams, and that under Mr. E. C. Sherman, charged with the design of the spillways. Both of these finished their designs in the course of the year and were disbanded. A contract having been let for the emergency dams, the services of Mr. Monniche were retained in connection with the inspection of the fabrication and erection of these structures, a special force being organized for this purpose.

At present the division is organized into subdivisions in charge of designs and work as follows: (a) Masonry and lock structures, including valves; (b) lock gates and protective devices, including the inspection of construction and erection of the same; (c) operating machinery and electrical installation, including inspection and erection of the same; (d) movable dams, including inspection of construction and of erection under contract; and (e) aids to navigation, including construction of the same.

#### MASONRY AND LOCK STRUCTURE.

This subdivision is under charge of Mr. L. D. Cornish, designing engineer, assisted by Mr. H. F. Tucker, designing engineer; Mr. T. E. L. Lipsey and Mr. A. R. Brown, assistant engineers; and the necessary draftsmen.



### LOCKS.

At the beginning of the last fiscal year the general designs of all the locks had been adopted and the detailed drawings needed by the working force in the field had been made and issued from time to time.

During the fiscal year ending June 30, 1911, all the general plans of the locks, embodying the features previously adopted, have been approved and issued except the plans of the lower portion of the lower locks at Gatun and Miraflores. The detailed plans have been prepared and issued from time to time as needed in the field.

### APPROACH WALLS.

At the close of the last fiscal year designs for all the approach walls at Pedro Miguel had been adopted with the exception of the north middle approach wall. Designs for the northeast and northwest side approach walls for Miraflores Locks had been adopted as well as for the south middle approach wall at Gatun. During the year the design for the remaining approach walls at all localities has been finished except that for the south middle approach wall for Miraflores, which is now under study.

### VALVES AND FIXED PARTS.

Plans have been completed and approved for the fixed irons for the valve and gate chambers in all locks; and in the Gatun and Miraflores spillways; for the cylindrical valves for all the locks; for the Stoney gates for the spillways, and for rising stem gate valves for the locks, including all roller trains, sealing devices, etc., for the above gates and valves; for guard valves, snubbing posts, screens, bulkhead gates, lateral culvert valves and bridges at intakes, and other miscellaneous iron work.

### DRAWINGS.

In providing the plans for the features hereinbefore mentioned, 133 drawings have been made, approved, and issued.

### CONTRACTS.

At the end of the last fiscal year contracts were in force as follows:

Dated March 2, 1910, with the Wheeling Mold & Foundry Co., of Wheeling, W. Va., for frames for valves and bulkheads for upper Gatun and Pedro Miguel Locks. During the year this contract has been practically finished, 16 tons of material only remaining yet to be delivered.

Dated July 10, 1909, with the Penn Bridge Co., of Beaver Falls, Pa., for 2 sets of rising stem valves. Delivery under this contract was completed August 30, 1910.

Dated July 10, 1909, with the Rosedale Foundry & Machine Co., of Pittsburgh, Pa., for 40 cylindrical valves. Delivery under this contract was completed September 2, 1910.

During the past fiscal year contracts have been let as follows:

Dated September 1, 1910, with the Wheeling Mold & Foundry Co., of Wheeling, W. Va., for 34 sets of frames for rising stem gate valves. This contract covers all the valve frames which had not previously been contracted for. It involves 2,585 tons of castings, and the total consideration is about \$213,000. At the close of the fiscal year this contract was about 53 per cent completed.

Dated August 11, 1910, with the Rosedale Foundry & Machine Co., of Pittsburgh, Pa., for 80 cylindrical valves, completing the total number required for all the locks. The price for about 1,100 tons of material was about \$127,000. Delivery under the contract was completed February 13, 1911.

Dated August 11, 1910, with the Pennsylvania Steel Co., of Steelton, Pa., for 360 snubbing hooks and 80 girders, all that will be required for the locks. The price for about 387 tons of material was about \$23,000. Delivery under the contract was completed January 3, 1911.

In addition, specifications were prepared and advertised as Circular 636 for proposals, to be opened July 24, 1911, for the following material:

Class 1, 22 spillway gates, 2 steel caissons and footbridges, complete, for the spillways of Gatun and Miraflores lakes, covering about 1,115 tons of material.

Class 2, 130 rising stem gate valves, 12 guard gate valves, 6 lateral culvert valves, 39 bulkhead gates, and 36 screens for intakes, covering about 2,000 tons of material.

Class 3, fixed irons for 22 sets of spillway gate seats, covering about 515 tons of material.

Class 4, roller trains and sealing devices for the spillway gates and rising stem valves in classes 1 and 2, covering about 510.8 tons of material.

Class 5, railings for spillway bridges and piers, covering about 34 tons of material.

Specifications were also prepared for circular advertisement for proposal to furnish 6 steel girder bridges for intakes at Pedro Miguel and Miraflores Locks and for structural steel for decking of machinery chambers of all locks. The estimated amount of material is 560 tons.

The total estimate for material advertised but not yet contracted for is 4,735 tons, at estimated cost of \$651,520.

#### CASTINGS MADE ON THE ISTHMUS.

In addition to the ironwork furnished from the United States, the commission's foundry at Gorgona has made or fabricated, in accordance with the designs of this subdivision, about 954 tons of castings and structural material.

#### TEST OF VALVES.

A series of tests of the rising-stem gate valves was inaugurated under the direction of this office, with a view of ascertaining the friction coefficient and leakage under working conditions.

The first test was made by assembling a valve and roller train in a horizontal position and loading the valve with pig iron to simulate the working water pressure, and observing, by means of a dynamometer, the force required to move the valve and to keep it in motion. From this test was obtained a coefficient of static friction at initial movement of 0.0198 and rolling friction of 0.0147. (See Pl. 1.)

The details of this test may be found in the report of the division engineer of the Atlantic division, Appendix B, by whose force the test was conducted.

This test is being supplemented by others in which actual working conditions are very closely approximated. The gates have been installed in the upper valve chamber of the side culvert, the entrance to the culvert has been closed with a water-tight bulkhead, and the culvert above the gates with a well connecting the same to the top of the wall has been filled with water. When the water reaches the coping level there will be a head against the valve slightly greater than that which will obtain when the lock is pumped dry for examination, and considerably greater than the usual operating head. Under this condition it is proposed to measure the leakage and also the force required to start the valve and to maintain motion for a distance of about 1 foot. These tests have been begun and are now in hand.

One of the cylindrical valves in the Pedro Miguel Locks was tested for leakage from the interior by constructing a temporary floor or bulkhead across the lateral culvert about 3 feet below the valve seat. The valve and 10-inch casing extending to the top of the lock wall were filled with water, thus obtaining a head of about 65 feet on the valve seat. The leakage under this head was found by measurement to be about 0.128 cubic feet per second, or about 1.3 cubic feet per second for the 10 valves in each lock.

#### LOCK GATES AND PROTECTIVE DEVICES.

This subdivision has been under the immediate charge of Mr. Henry Goldmark, designing engineer, assisted by Messrs. J. Soderberg, F. E. Sterns, and L. A. Mason, assistant engineers and the necessary draftsmen.

The duties of the subdivision have been increased by the addition of responsibility for the technical matters relating to the inspection of material for the lock gates and of the charge of the field inspection of the construction of these gates on the Isthmus. These additions have necessitated the organization of a considerable inspection force both in the United States and on the Isthmus.

#### LOCK GATES.

At the close of the fiscal year 1910, the fixed parts pertaining to mitering lock gates, such as anchorages, sill castings, quoin castings, etc., were under contract with the United Engineering & Foundry Co. of Pittsburgh, Pa. Final delivery of all the material under this contract was made during the last fiscal year.

On June 21, 1910, contract was made with the McClintic-Marshall Construction Co. of Pittsburgh, Pa., for the construction of the gate

leaves proper. Under this contract work has been in progress during the entire fiscal year.

On the basis of the contract drawings and specifications furnished by the commission, modified in some details as the work progressed, the contractors have prepared, during the course of the fiscal year, about 200 shop plans for the structural work, castings, handrailing, etc.

The structural steel was rolled mainly at the mills of Jones & Laughlin, at Pittsburgh, Pa., though some of the wider plates were made by the Carnegie Steel Co. at their Homestead works, and a small amount of material at other mills. The total rolled material accepted to the end of the fiscal year was 26,135 tons, while the rejections on tests amounted to 2,104 tons.

All castings, including manhole covers, etc., were made by the Wheeling Mold & Foundry Co., of Wheeling, W. Va.

Chemical and physical tests were made by the commission's inspectors on small-sized test pieces cut from all finished rolled material and castings, and a very careful surface inspection was also carried on in the rolling mills and foundries, as well as in the shops where the material was assembled.

Two of the cast-steel yokes by which the tops of the gate leaves will be connected to the anchors in the masonry were tested to destruction by tension in the large testing machine at Ambridge, Pa. These yokes are vanadium steel castings, which, by the specifications, are required to contain 0.16 of 1 per cent of vanadium. The typical test specimens indicate an elastic limit of over 40,000 pounds, ultimate strength of 70,000 pounds, and elongation of 24 per cent in 2 inches. The full-size yoke after fracture is shown on accompanying photograph. (Pl. 2.) The fracture took place when the stress required to break the yoke was about 3,300,000 pounds, which is about seven times the greatest load that can ever come upon the yoke even when the gate is swung free in the dry.

The specifications provide for a very high grade of workmanship. To enforce the same and insure good fitting in the field, experience has shown that a very detailed inspection, involving the measuring up of practically all dimensions, is absolutely necessary. This has required a rather large body of inspectors and very thorough and systematic work on their part.

The inspection has now been thoroughly systematized, and is keeping pace with the rapid work in the rolling mills, foundries, and shops.

Practically all structural parts are thoroughly cleaned by sand blasting or pickling. Where the latter process is used the steel is immersed in a mixture of sulphuric acid and water. The material is then washed by a jet of water under high pressure; afterwards immersed in a lime bath to remove the excess of acid, and finally given another washing by a water jet. The sand blasting and pickling processes seem to be equally efficient in removing all mill scale and rust. In the cast of the large girders riveted up in the shops, sand blasting was used exclusively, the girders being riveted up complete before being painted. All parts are painted very soon after this cleaning.

The shops, by the end of the fiscal year, had completed, ready for shipment, practically all the material for the 8 leaves 54 feet 8 inches in height, comprising the upper guard gates in Gatun and Pedro Miguel Locks; 8 leaves 77 feet high for the upper and middle gates in the upper lock at Gatun were also very nearly finished, while 8 more leaves 77 feet high for the safety and lower gates in the same lock were about half done.

Shipments from the shops aggregated about 7,000 tons, comprising almost all of the material for the upper guard gates at Gatun and Pedro Miguel and about 35 per cent of the total weight in the remaining gates for the upper lock at Gatun.

In accordance with the specifications, one leaf 54 feet 8 inches high and one leaf 77 feet high were completely erected at the contractors' shops in Pittsburgh as a check on the correctness of the workmanship. These gates were erected vertically in three or four sections for each leaf, all structural parts being completely assembled and the larger part of the castings. The connections were made by temporary bolts, without reaming out the rivet or bolt holes.

The output of the shop has now reached about 900 tons per week, or nearly one and a half leaves; if this rate is maintained the material for nearly all the gates will be completed at the works before the end of the fiscal year 1912.

The contract provides for beginning the erection of the gates at Gatun January 1 and at Pedro Miguel March 1, 1911. Owing to delays in delivering the material for the gate leaves, the contractors did not begin the actual erection until much later, although their erection plant was ready for use at dates not much after those named in the contract for beginning the work. The work of attaching the nickel-steel bearing plates to the castings in the hollow quoins was begun March 21, 1911. These plates were furnished by other contractors, but the erection of the same forms a part of the McClintic-Marshall contract. By the end of the fiscal year the plates for the upper guard gates at Gatun were fitted and babbitted and work had begun on the quoins for the upper gates in the same lock. The first material for the leaves reached Cristobal May 7, 1911, consisting of about 1,500 tons for the upper guard gates at Gatun and Pedro Miguel. The bottom girders for the four leaves in the upper guard gates at Gatun were placed in position May 17 and 18, thus beginning the erection of the gates. By the end of the fiscal year the skeletons, viz, the girders, vertical frames, diaphragms, and intercostals in these four leaves for a height of four panels, had been placed in position, and those in the east chamber had been completely riveted. The attachment of the sheathing plates had also begun.

No permanent work has been done at Pedro Miguel or Miraflores, but the bridges, cranes, etc., for the erection were practically in place at the upper end of Pedro Miguel Locks.

The condition of the work at the end of the fiscal year in Gatun locks is shown in accompanying photograph, which includes a view not only of the gates as far as erected, but also of the erection bridge spanning the east chamber and the locomotive crane with which all the material is handled. (See Pl. 3.)

## CHAIN FENDERS.

As stated in the annual reports of 1908 and 1909, it has been determined to place at certain points in the lock flights guards for the gates in the form of chain fenders. These fenders will be placed about 500 feet above and 230 feet below the upper and lower guard gates, respectively, in the locks at Gatun, Pedro Miguel, and Miraflores, and also at points 80 feet and 100 feet, respectively, above the hollow quoins of the middle and safety gates in the Pedro Miguel Lock and in the upper chambers at Gatun and Miraflores.

The chain fender consists essentially of a heavy chain, which, when in use, is stretched across the lock near the surface of the water, being lowered to the bottom of the chamber when a vessel is about to pass the gates it protects. Its purpose is to form a barrier to the passage of a ship, gradually stopping the latter with as little injury as possible to the vessel or the fender. To accomplish this result the chain is arranged so as to pay out against a resistance when struck by a vessel.

A device of this kind has been in use in England for about 15 years, having been originally fitted to the Barry Docks in 1896, and since then to various other docks, including the Grangemouth and Tyne Docks, also the Avonmouth Docks at Bristol and the Immingham Docks near Grimsby. In these English fenders 1½ inch chains are used. The resistance to paying out is obtained by the friction of two or more turns of the chain about a fixed horizontal drum, or bollard, placed on one of the lock walls. The chain is lowered and raised by an hydraulic engine on the other wall. While this mechanism works well as far as the raising and lowering of the chain is concerned, the method for producing resistance to the paying out of the chain is uncertain in its action.

An extended study has been made during the past three years to arrive at a more satisfactory design. The use of a heavy chain, arranged for raising and lowering as described above, was adhered to throughout in these studies. It was deemed advisable, however, to install the machinery for raising and lowering the chain, as well as for furnishing the resistance to its paying out, on both of the lock walls. By lowering it from both sides the chain can not fail to rest on the bottom for the entire width of the lock. The symmetrical arrangement of the fender also greatly increases its resisting power, especially for vessels not moving in the exact center line of the lock.

Various designs were considered, differing in their operating machinery for lowering and raising as well as in the methods for producing the resistance to the paying out of the chain.

Three forms of resistance were studied: First, the raising of heavy weights; second, the friction of metallic surfaces; third, the flow of a fluid through small orifices.

The type of operating machinery is largely independent of the method for producing the resistance, and winding engines moved by electric motors were adopted in all the designs studied, except in the plan using a fluid resistance, where the chain is raised and lowered by hydraulic machinery.

The principal objection to the use of weights for checking the travel of the chain is the enormous mass required when large vessels are to be stopped. Very large recesses would be needed in the

masonry, while the length of chain available, and hence the total capacity of the fender, would be less than with other types. This type of fender was made the subject of preliminary study only.

Designs were quite fully developed, using metallic and hydraulic friction, respectively. In the first-named case the operating machine resembles quite closely the windlass used for the anchors of large vessels, though electric motors were proposed instead of the steam engines used on ships.

Drawing No. 63 (Pl. 80) shows a design of this kind, which was developed in considerable detail. A post brake is used in this plan, as being more certain in its action than the more common band brake. The chain passes over a wildcat or sprocket wheel, and to guard against its fouling when paying out, a deep but narrow pit is provided, into which the inboard end of the chain drops when the chain is in its upper position. The operation of the machinery when raising and lowering the chain can be readily understood by an examination of the plan. The brake comes into action only in case of emergency, when a heavy counterweight is applied by suitable mechanism. This design is compact, provides an ample length of chain, and when in good working order would be thoroughly efficient.

It has, however, certain drawbacks inherent in this type. These are, first, the variability in the coefficient of friction, particularly in this climate, which might cause the amount of resistance to the paying out of the chain to change somewhat from day to day. Second, the devices for lowering the counterweight in an emergency are necessarily rather complicated. Third, the use of wildcats as here employed is somewhat experimental. Their wear would probably be considerable and their action unreliable. For this and other reasons the hydraulic type was chosen for first trial.

The design to be tested is shown on drawing 5224 (Pl. 81), submitted herewith.

The mechanism for raising and lowering the chain consists in the main of a system of hydraulic cylinders operated by a centrifugal pump, connected to an electric motor and the necessary sheaves, bearings, and connections for attaching and supporting the chain. There is, at the top, a stationary outer cylinder bored out at its lower end to receive a moving combination plunger-cylinder or intermediate cylinder. This, in turn, has its lower end bored out for a stationary hollow plunger which rests on the bottom of the pit. The intermediate cylinder carries two sheaves by means of vertical eyebars attached at their lower extremities to a crosshead. Two similar sheaves are arranged at the top in stationary bearings supported on riveted girders spanning the pit. These sheaves are at right angles to the lower sheaves. The chain passes through a hawse-pipe casting of steel in the lock wall, being supported on an idler close to the edge of the wall. It makes a quarter turn around one of the stationary sheaves, then passes down and makes a half turn around one of the lower movable sheaves, rises up again, making a half turn around the second stationary sheave and going down on the other side of the machine. It then makes half a turn around the second movable sheave and passes up to one of the beams at the top of the pit, to which the end of the chain is securely fastened. The hawse-pipe casting, which resists the entire horizontal pull on the chain, is secured to heavy riveted steel anchors deeply embedded in the concrete.

The upper end of the outer cylinder is attached to the girders which extend across the top of the pit, to the upper side of which the stationary bearings for the upper sheaves are bolted. The large vertical reactions of the outer cylinder and the upper sheaves are therefore practically balanced, so that they produce very small bending moments on the structural frame. The tension in the horizontal portion of the chain, leading from the first stationary sheaves to the hawse pipe, is balanced by a riveted strut connecting the horizontal beams to the hawse-pipe casting. The unbalanced moment due to this arrangement is small and is readily taken care of by the structural girders embedded in the concrete.

The lower end of the stationary plunger is attached to the bottom of the pit by means of a base casting, securely fastened by anchor bolts. The intermediate cylinder is moved vertically by introducing the water through the pipe leading to the top of the outer cylinder for a downward movement which raises the chain, or through the pipe leading to the bottom of the stationary plunger for an upward movement which lowers the chain. The maximum pressure required for this movement is about 60 pounds per square inch.

The large stationary cylinder at the top has an internal diameter of 40 inches and the metal is 2 inches thick. It is built of cast steel in sections connected by flanges and bolts. The intermediate cylinder is of cast iron, but is provided with horizontal ribs at close intervals to withstand the heavy external pressure to which it may be subjected. The cover is to be of cast steel. The thickness of the metal in this cylinder is about  $2\frac{1}{2}$  inches. The joints between the intermediate and the outer cylinder and also between the intermediate cylinder and the stationary plunger are kept tight by stuffing boxes and glands, which may be tightened without removing a single part or interfering with the working of the machine. Any leakage which may occur at these stuffing boxes can be detected on the outside of the machine. In this respect a system of plungers is superior to a cylinder and piston, and it is, in addition, cheaper in first construction, and avoids the great difficulties inherent in boring out very large cylinders and obtaining a smooth and perfect interior surface. The system of plungers, being of necessity rather heavy, has the further advantage of counterbalancing in part the tension of the chain when being raised, also when it is finally stretched across the top of the lock chamber.

The sizes of the cylinders have been based on the stress in the chain and the permissible size of the pits in the concrete walls. The emergency tension in the chain was fixed at 220,000 pounds, or nearly 100 gross tons, which is about 40 per cent of its breaking load. The depth of the lock chamber is in some cases as great as 81 feet. The permissible depth of the pit in the wall is about 55 feet. The arrangement of sheaves shown on the plan gives a fourfold reduction, the travel of the intermediate cylinder being about 21 feet. This will allow the chain to pay out 85 feet from each lock wall, which is sufficient for lowering it to the grooves in the floor of the lock chamber, and is also sufficient to allow an ample travel of the chain when stopping vessels.

In addition to the cylinders, sheaves, etc., described above, there are required for the operation of the chain, that is, for lowering and



raising it into position, a centrifugal pump and operating valve, 2 check valves, the necessary piping, and an open water tank. Their position is shown, as far as feasible, in the general plan, drawing 5224 (Pl. 81). The piping system can not be shown without confusion. The piping and method of operation is, however, indicated in the diagram shown on the same sheet.

The resistance to the paying out of the chain, which is, of course, the most important feature of the design, is provided by one or more resistance valves placed in the pipe line and described somewhat more fully below. In the diagram the full lines show the position of the operating valve when the chain is being raised. The valve is left in this position when the chain has reached its proper height and is stretched across the top of the chamber. When the chain is struck by a ship the water pressure in the large outer cylinder rises gradually, the resistance valve being so designed that when a pressure of about 750 pounds per square inch is reached the valve will open and allow a sufficient amount of water to escape to keep this pressure constant until the vessel is stopped. This pressure of 750 pounds corresponds to a stress of 100 gross tons on the chain.

The dotted lines show the operating valve in position for lowering the chain. The valve is left in this position when the chain has reached its lowest position, at the bottom of the lock. Means will be provided for automatically starting the pump if through leakage the chain should move from the upper or lower position. The operation of raising and lowering the chain requires the cylinders to move very frequently. This is a great advantage as it will insure the proper working of all moving parts whenever the fender is called upon to stop a vessel.

The function of the resistance valve is to insure the paying out of the chain, after it is struck by a vessel, under a constant predetermined stress. This is equivalent to the maintenance of a constant fluid pressure in the outer cylinder. A similar problem is solved in the recoil cylinders of disappearing gun carriages, where a constant pressure is maintained by the resistance to the flow of a fluid through an orifice, the area of which varies with the length of travel, but can be definitely fixed for a given gun and service charge. Considering the great variation in the speed of vessels, and hence in the rate at which the water must escape from the cylinder, an orifice of fixed cross-section would by no means answer for the fender-chain mechanism, as it would give a low resistance in the case of slowly moving vessels, even though of large tonnage, while the resistance would be high only when the speed of the ship striking the chain should be considerable.

Provision must consequently be made for varying the cross-section of the aperture from instant to instant, as the rate of flow rises and falls. Relief valves, such as are used for regulating the pressure in high-pressure water and steam lines, are designed to meet this condition, and it is possible that with some modifications standard valves of this type may serve our purpose. It is proposed to test one or more such valves. In view of the importance of the subject and the high pressures and large flow involved, a special valve has, however, been designed in this office which it is believed will meet all requirements. It is a differential piston valve, the movement of

which is regulated by a properly adjusted helicoidal spring. Under ordinary operating conditions, when the pressure in the cylinders and piping never exceeds 60 pounds per square inch, the valve remains firmly seated. When, however, the chain is struck by a vessel, the pressure will rapidly rise and the valve should open against the reaction of the spring as soon as the desired pressure of 750 pounds is reached. With variations in the rate of flow, the ports for the discharge of the water will automatically open a greater or less degree so as to insure, as near as may be, a constant pressure at all times. A valve, now being built according to this plan, is to be tested for its efficiency under conditions approximating to actual service.

The calculated efficiency of the fender in checking the movements of vessels is shown by the diagrams on drawing No. 5225 (Pl. 82), submitted herewith. The chain is assumed as paying out under a constant pull of 100 gross tons, so that each foot paid out corresponds to 100 foot tons of energy. The curves represent the kinetic energy of vessels varying from 1,000 to 50,000 tons in displacement and moving at speeds up to 6 knots. After a ship has struck the chain its speed is continuously reduced, its energy being gradually absorbed by the chain fender. The horizontal abscissas of the points marked 20, 25, etc., give the total energy absorbed by the fenders when a vessel, the bow of which remains in contact with the chain, has traveled 20, 25, etc., feet after first striking the chain. The vessels would be brought to a stop after traveling 20, 25, etc., feet, if their initial speeds when striking the chain were those given by the vertical ordinates to the several curves at the points 20, 25, etc. The large capacity of the fenders will be apparent from an examination of these curves. Thus, at the lower ends of the upper locks, where the available distance between the chain and the lock gates is about 70 feet, vessels of 5,000, 10,000 and 60,000 tons displacement should be stopped from speeds of 5.5, 3.9, and 1.5 knots, respectively. The gross tonnage of the *Olympic* is about 60,000.

It should be noted, however, that the calculations are based on vessels moving along the axis of the lock so that the chain will pull out equally from both sides. In case the vessel is nearer one of the lock walls or is not moving parallel to them, a greater length of chain will be drawn out from one side than the other and the total stopping power will be somewhat less. The great advantage in this last case of an apparatus which provides for the paying out of the chain from both walls can readily be seen.

The masonry has been planned to permit installation of the hydraulic resistance described above. A sample machine will be constructed and tested as soon as practicable; and definite decision as to the adoption of the device must await the result of the test. As an alternative, frictional resistances may be installed in case the hydraulic apparatus should prove unsatisfactory.

#### FLOATING CAISSON GATES.

The studies for these gates have been continued during the fiscal year and a detailed design practically completed for a caisson of the molded ship type. They will serve to close off the head and tail bays of the lock flights, and will be the only means available for permitting the lower guard gates to be examined, cleaned,

painted, and repaired. For closing the upper ends of the locks, the caissons will probably be more satisfactory than the emergency dams, besides enabling the sills of the latter to be examined in the dry.

Each caisson, as planned, is to be equipped with three 20-inch and one 8-inch centrifugal pumps driven by electric motors. These are intended not only for pumping out the caisson itself, but also for unwatering the locks.

The principal dimensions of the caissons are the following:

	Feet.
Length between vertical ends.....	112½
Depth at side.....	65
Breadth molded.....	36
Draft light.....	32
Draft extreme.....	61

The great depth is made necessary by tidal conditions at the lower end of Miraflores Lock.

In the design of the caisson, the required statical stability at the various depths of immersion to which it will be subjected has been carefully considered. In form the bottom will be convex, the ends pointed, and the sides will slope in from its greatest breadth (at about one-third the depth from the keel) to the top deck, which is 18 feet in breadth for about one-half of its length.

The lower interior part is cellular in construction, with nine transverse bulkheads extending from the keel to a height of 25 feet. Two of these bulkheads, which are in reality collision bulkheads, are located about 8 feet from the ends so as to form longitudinal trimming tanks of the end compartments. There will be a bulkhead along the center line extending longitudinally from collision to collision bulkhead and in height to about two-thirds of the depth of the caisson. This central bulkhead will be made sufficiently water tight to form two distinct compartments, thereby dividing the free surface of the water ballast.

As it is desirable that the side walls of the locks shall carry practically all the static load from the caisson, there will be a number of horizontal decks and end breasthooks to carry this load to the vertical ends, and a system of vertical framing built intercostally and extending from the keel to the top deck will transmit the panel loading to the horizontal decks and end breasthooks. Along the same horizontal line and extending from end to end of the breasthooks, there will be intercostal stringers.

It is proposed, as an alternative to the above plan, to prepare a design somewhat simpler in construction, avoiding largely the use of curved frames and plating. This type has been used of late years in dry-dock caissons for the United States and British Navies and is supposed to be somewhat cheaper in first cost.

#### OPERATING MACHINERY.

This subdivision has been under the direct charge of Mr. Edward Schildhauer, electrical and mechanical engineer, assisted by Mr. E. E. Lee, assistant electrical and mechanical engineer, and Messrs. C. B. Larzelere and W. R. McCann, assistant engineers, with the necessary draftsmen and clerk. Messrs. F. A. Browne and F. C. Clark, as-

sistant engineers, were also employed in the subdivision on the Isthmus until May, 1911, when, in company with Mr. A. L. Bell, draftsman, they were sent to the United States to organize a force for inspecting the construction of certain machinery designed in the subdivision.

#### MACHINERY FOR RISING STEM AND CYLINDRICAL VALVES.

The details of the machines for the valves were described in the last annual report. On July 18, 1910, proposals were invited, by Circular 596, for furnishing and erecting 2 machines of each class, with the option of extending the purchase to include 46 additional machines for the rising stem valves, and 38 additional machines for the cylindrical valves, the total number which thus might be purchased being sufficient for the installation at Pedro Miguel and upper Gatun locks. Bidders were invited to state different prices for the sample machines and for the balance of the order. There were seven bids in response to this invitation, all of which were regarded as excessive. After an unsuccessful attempt to obtain satisfactory terms from the bidders on the basis of the commission assuming the erection of the machines, all bids were rejected, and the work was re-advertised in Circular 614, with modified specifications embodying only a few changes in material and a change in the stem for the rising stem valves. Owing to the delay incident to the failure to award at the first letting, it was not thought advisable to limit the option to the machines needed for the first two locks, and in the new call the option was reserved to purchase all the machines needed for the entire canal, if the samples should be satisfactory. The call was, therefore, for 2 rising stem-valve machines with option on 114 more, and 2 cylindrical-valve machines with option on 118 more. The motors and limit switches for each class of machine were called for in the same manner. Especial effort was made to attract the attention of foreign bidders to the contract. Bids were opened on February 25, 1911, there being 11 bidders for the rising-stem valve machines, 15 bidders for the cylindrical-valve machines, 4 bidders for the motors for each machine, and 7 bidders for the limit switches. Certain material of foreign manufacture was offered in connection with the tenders of some domestic bidders, and there was one bid from a foreign company for the motors. The Wheeling Mold & Foundry Co. were the lowest regular bidders for both classes of valve machines, and two sample machines of each class have been ordered from that company, the award for the remainder being held in abeyance until trial has been made of the first two furnished. It is to be noted that an important item in bringing the bid of this company for the rising-stem valve machines below its competitors was that it offered for the valve stems Mannesmann tubing, made in Germany, at a price which indicated that these tubes, free of duty, cost less than one-half the sum at which domestic material was offered. The company's bid was such that, assuming all the machines are ordered, the average price will be \$5,789.43 for the rising-stem valve machine and \$861.51 for the cylindrical-valve machine.

Sample motors were ordered for each of the machines from each of the following bidders: Allis-Chalmers Co., Westinghouse Elec-

tric & Manufacturing Co., and the General Electric Co. The award for the remainder of the motors will be held in abeyance until after the trial of the sample motors.

The average price of the one motor for the rising stem valve machines will range between \$710 and \$567, and of one for the cylindrical valve machines, between \$350 and \$277, depending upon the bid which is ultimately accepted.

The award for two limit switches for each class of machine was made to the following bidders: Cutler-Hammer Manufacturing Co., Westinghouse Electric & Manufacturing Co., and the General Electric Co. The award for the remainder will be made after the trial of the sample machines. The average price of one limit switch will be between \$50 and \$60, according to the bid which is ultimately accepted.

The lowest bid received on both classes of motor was made by the Swedish General Electric Co. Even with the duty added, this bid was slightly lower than any received from a domestic concern. It was, however, informal in certain respects, and was not received until some weeks after the time set for opening the bids. After consideration it was held that it could not properly be accepted.

The total consideration of all contracts to be let under this circular will, if the trial of the samples proves satisfactory, amount to about \$905,000. This cost is an average of 13.2 cents per pound for the machines, complete, including motors and limit switches, but exclusive of spare parts, inspection, and erection. Had the same amount of material been purchased on the basis of the bids received at the first advertisement, it would have cost the Government, in round numbers, \$500,000 more.

#### MACHINES FOR GATES.

The machines for operating and locking the gates were described in the last annual report. By Circular 627 bids were invited for the gate-moving machines and miter forcing machines, with motors for both classes. The same policy was pursued as in the case of the other machines, namely, to ask prices on sample machines, and also on the remainder of the machines should the samples prove satisfactory. Thus, different prices could be bid for the samples, of which the cost would be higher than for the remainder of the machines, which would cost much less after development of patterns and methods in the construction of the sample. The circular called for bids on two miter gate-moving machines, with option on 90 more, and for one miter forcing machine, with option on 45 more. The necessary motors and limit switches were included as separate classes. The tenders were opened on March 24, 1911. Ten bids were received for the miter gate-moving machine, of which that of the Wheeling Mold & Foundry Co., of Wheeling, W. Va., was the lowest. Their total price for 92 machines, including spare parts, was \$652,064. Award will be made to the company for the sample machines, decision as to the balance to be made after these have been tested.

The Wheeling Mold & Foundry Co. offered an alternative proposal reducing the price if the assembling of the machines be waived and certain changes made in connection with payment. This propo-

sition will be considered should purchase of the remaining 90 machines be made from this company. It would reduce the actual price per machine to \$6,817.15.

The lowest bid for class 2, miter forcing machines, was that of the Richard Manufacturing Co., of Bloomsburg, Pa., the total price for 46 machines and spare parts being \$41,275.50. Twelve bids were received on this class. Award will be made to the lowest bidder for 1 sample machine, reserving option on the remaining 45.

Bids for the motors were received from the Allis-Chalmers Co., the Westinghouse Electric & Manufacturing Co., and the General Electric Co. No decision as to the award had been made at the close of the fiscal year.

The total cost of 92 miter-gate-moving machines, including motors and limit switches, basing the cost of the latter two items on the lowest regular bid, will be \$698,300, inclusive of inspection, erection, and spare parts. This price is \$138 per ton, or 6.9 cents per pound.

On the same basis the total cost of 46 miter-forcing machines will be \$54,700, or 11.9 cents per pound.

#### VALVE MACHINES.

In addition to the machines for the regular rising stem and cylindrical valves, certain other valve machinery remains to be purchased, although in much smaller quantities. To operate the valves of the auxiliary culverts which pass around the hollow quoins of the double gates and regulate the water level between these sets of gates, machines resembling the cylindrical valve machines in all except minor respects will be needed. These machines it is proposed to purchase under the contract for cylindrical valve machinery. The machines for the valves which close the intakes of the side walls at the upper ends of the lock must also be different from the rising stem valve machines, inasmuch as the head room there is insufficient to permit using a rigid stem. It will be necessary, therefore, to operate these valves with a flexible connection in the manner in which many Stoney valves are operated in other works. A type of machine has been approved, and the design is about 90 per cent finished.

#### TOWING DEVICES.

During the year contracts have been let for the material for the rack railway upon which the towing locomotives will run. A small quantity was purchased separately for the return track of the side wall at Pedro Miguel and the upper lock at Gatun in order to avoid delaying the work of construction. The main contract was advertised as Circular 619, proposals being opened March 24, 1911. Awards under this circular were made as follows:

Class 1, 7,202,500 pounds structural steel, to the United States Steel Products Co., at a unit price of \$0.01749 per pound.

Class 2, 6,557,870 pounds steel castings (rack), to R. C. Hoffman & Co., at a unit price of \$0.03775 per pound.

Class 3, 487,736 pounds malleable iron, to the Ross-Meehan Foundry Co., at a unit price of \$0.03289 per pound.

Class 4, copper conductor rails, etc.; class 5, crossovers and turn-outs; class 6, insulators; and class 7, steel bolts, nuts, screws, etc., held in abeyance, owing to the fact that no satisfactory bids were received for classes 4 and 5, upon the former of which classes 6 and 7 depend.

Class 8, 33 bumping posts, to the Railway Traction & Supply Co., at a unit price of \$67.50.

It is hoped to advertise the contract for the electric towing locomotives in the near future.

#### SPILLWAY GATE MACHINERY.

The contract will be advertised in the near future.

#### HOISTING MACHINES FOR GATES AND GIRDERS OF MOVABLE DAMS.

Design for the machines for raising and lowering the girders and gates of the movable dam have been completed and specifications prepared. The machinery is included in the contract for the emergency dam, let under date of May 16, 1911.

#### WICKET-GIRDER HOISTS.

The wicket girders are raised and lowered by means of two 7-part lines. The lead lines pass over sheaves at the end of the booms and are carried back to the hoisting drums. The machinery for each girder is composed of two hoisting units and one motor unit. (See drawing 5563; Pl. 83.) The hoisting unit consists of a drum with its gearing. Both worms are driven by silent sprocket chains from the motor unit. All gearing and the sprocket chains are inclosed in oil-tight cases to afford complete protection against the weather. Each machine is controlled separately from the operating platform directly in the rear. The operation of lowering the wicket takes place at high speed, while lower speed is used for raising the wicket. By turning the handle of the controller to the lowering position, the motor is started, and, at the same time, a solenoid is energized which draws the jaw clutch on the motor shaft into mesh with the high-speed gearing. The girder is lowered at a uniform rate of speed to its seat in the floor of the lock, the time of lowering being 4 minutes. In case of failure of the electric current, the girder can be lowered into place by means of hand-operated capstan. Should it be found necessary to raise the girder against the current to allow an obstruction to be washed out of the girder seat, this can be done by bringing the controller handle to the hoisting position. This movement engages the clutch with the slow-speed gearing, and the girder is hoisted back to its original position, the time of hoisting being 18 minutes. A limit switch stops the movement in either direction at the proper time.

#### GATE-HOISTING MACHINE.

The object of this machine is to lower and hoist the gates which close the openings between the wicket girders. It consists essentially

of several hoisting drums, loose on a common drum shaft. (See drawing 5576; Pl. 84.) This shaft is motor driven through spur gears and a worm and worm gear. The worm gearing is self-locking and will hold a gate in any position when the motor is stopped. Each gate has its own pair of drums, to which it is connected by two flat wire ropes. Each pair of drums can be thrown in or out of service by jaw clutches. While handling a gate, all drums not attached to this gate are out of service. They are held from moving by detent levers, which engage automatically whenever the jaw clutches are withdrawn.

Normally, all gates except those of the lowest tier are hooked to trolleys which run on rails fastened to the main floor of the dam. The gates of the lowest tier, or gates No. 1, are kept habitually on the wicket girders, when the latter are in the raised position, and can be lowered at once after the girders have been lowered. To lower the next tier, the jaw clutches of gate No. 2 are thrown in, all the other jaw clutches are disengaged, and gate No. 2 is hauled along the track until it hangs under the drums and its wheels are against the rails which guide it into the proper place on the runway formed by the upstream flanges of the wicket girder. The gate is then hoisted until it is automatically unhooked from the trolley. It is then lowered into place. To hoist the gate, the operations are reversed. The trolley track has sufficient slope toward the middle of the dam to cause the gates to run to their proper position for storage. The operation of placing the gates can, if necessary, be effected by hand, a capstan being provided, which is geared to the motor shaft.

When bids were opened for the movable dams, the prices at which the machinery was offered indicated that certain minor changes, such as the substitution of a less expensive worm and worm gear, would be advisable. Experiments looking toward this substitution are now under way.

#### FLOAT-WELL MECHANISM.

The mechanism to indicate the level of the water in the various locks through the float-wells left in the walls has been the subject of study, which was not completed at the end of the fiscal year.

#### LIGHT AND POWER.

Study has been given to the subject of lighting the coping and operating tunnels of the locks, and lighting plans for all the locks, so far as the masonry is effected, have been developed and completed, this work involving the preparation of 31 drawings. The drawings embodying the electrical features of this system are not yet complete.

#### COPING DRAINAGE.

The system of draining the coping of the lock wall has been developed in combination with the drainage of the machinery chambers, operating tunnel, and towing locomotive track. The main feature of this drainage is that all the water is carried to a drainage



tunnel running lengthwise of each lock wall under the cable conduit in the operating tunnel. The details of this drainage have been finished during the year, the work involving the preparation of 27 drawings.

#### HYDROELECTRIC STATIONS AND TRANSMISSION TIE LINE.

Study has been given to the electric system which will be used for the operation of the canal after completion. This involves a hydroelectric station on the Gatun Dam and an alternative generating station at Miraflores, the latter to be operated by steam and to be used only in case of accident to the hydroelectric generating station. The two stations will be connected by a transmission tie line, and current from either or both can be used for any of the operations of the canal. Specifications for the equipment of the hydroelectric plant were finished during the year, and it is hoped that contract for the material, which will to a large extent determine the layout of the floor of the station, will be advertised at an early date, in order that construction of the station may proceed to early completion.

#### MANHOLE COVERS, DUCTS, ETC.

A manhole cover consisting of a cast-iron frame with reinforced concrete filling of the largest size to be used, namely, approximately 10 by 4½ feet, was built during the year and tested to destruction. The remainder of the covers are being designed on the basis of this type, the test having been very satisfactory. Various methods of duct construction have been studied, and it has been finally resolved to use vitrified tile for this purpose.

#### LOCAL ORDERS.

In addition to the equipment furnished from the United States, orders have been placed with the commission's foundry at Gorgona for 640 tons of spillway counterweights for Gatun and 45 tons of miscellaneous cast-iron pipe for the towing locomotive track drains.

#### INSPECTION OF MACHINERY AND ELECTRICAL EQUIPMENT.

In the month of April, 1911, a force was organized in the United States for the purpose of handling all technical matters relating to the inspection of the mechanical and electrical equipment. In such technical matters this force reports directly to this office. All administrative matters connected with the inspection are in the hands of the general purchasing officer of the commission in Washington. The headquarters of the force have been established at Wheeling, W. Va., as most of the main contracts are to be carried out in that vicinity. At present this force is inspecting in whole or part the work under four contracts, namely, (1) for the Stoney gate and cylindrical valve machinery; (2) for the rack railway material; (3) for the gate operating and miter forcing machines; and, (4) for the machines for the gate and girder hoists of the emergency dams.

## ERECTION OF MACHINERY.

It has been determined that the machinery designed in this office will be placed by a force operating directly under its control. A tentative organization for the force has been prepared, and it is expected that erection will begin as soon as the sample machines have been received on the Isthmus.

## DRAWINGS, REPORTS, ETC.

One hundred and fifty-seven formal drawings have been prepared and approved during the fiscal year; 59 sketches, diagrams, and tabulations have been prepared in addition. Detailed reports have been made upon various questions connected with the business of the office which have arisen during the year.

## MOVABLE DAMS.

This subdivision was under the immediate charge of Mr. T. B. Monniche, designing engineer, assisted by Messrs. C. Derrick and F. H. Moore, assistant engineers, and the necessary draftsmen.

The office work of this subdivision was completed in the first part of December, 1910. On January 14, 1911, the work of constructing and erecting the dams was advertised under Circular 616. Tenders were opened on March 30, 1911, three regular bids being received as follows:

McClintic-Marshall Construction Co.....	\$2, 277, 872. 44
Pennsylvania Steel Co.....	2, 402, 619. 86
United States Steel Products Co.....	2, 238, 988. 40

The total amount of structural material involved in the contract is about 11,300 tons, exclusive of the concrete counterweights. The time pledged for completing the erection of the dams was as follows: At Gatun, August 15, 1912; at Pedro Miguel, January 15, 1913; at Miraflores, June 15, 1913.

After careful canvass of the bids, award was made on May 16, 1911, to the lowest bidder, namely, the United States Steel Products Co.

The office force on the Isthmus having been disbanded, Mr. T. B. Monniche, designing engineer, was placed in charge of the inspection of this material, and the organization was begun in the United States of an inspection force to handle the technical matters connected with this contract. The organization of this force is not yet complete, it having only 6 employees at present. The complete organization will consist of approximately 24 men.

## SPILLWAYS.

This subdivision was under charge of Mr. E. C. Sherman, designing engineer, with the necessary draftsmen.

The detailed drawings for Gatun spillway, which were under way at the beginning of the fiscal year, have been completed and approved and prints issued to the division engineer for construction purposes.

A number of slight changes were made from the general plan published in the last annual report, and a new general plan was prepared, which, with the corresponding longitudinal section, form record drawings and are reproduced with this report. (See drawings 4050 and 5060; Pls. 85 and 86.)

The general plan of the Miraflores spillway has been finished, with the necessary detailed drawings, and these have been issued to the division engineer for use in construction. The dam is illustrated in drawings 4503 and 4504 (Pls. 87 and 88) herewith.

Drawings have been prepared for the steel footbridge to span the crest-gate openings at both spillways and for the caissons which will be used to replace any defective gate and permit repairs to be made on the latter in the dry.

Upon the disbanding of the force under Mr. Sherman, which had completed the designs for the spillways rapidly and creditably, charge of further matters in connection with these parts of the work was turned over to the masonry subdivision of this office, in which the designs for the spillway gates had been made. The purchase of the footbridges, caissons, railings, etc., will be made in connection with the purchase of the spillway gates and the Stoney valves for the locks. Specifications for all this work were prepared and bids asked in Circular 636, dated June 9, 1911.

#### AIDS TO NAVIGATION.

This subdivision was organized in February, 1911, and is charged with the preparation and execution of a project for lighting and buoying the canal. The project which has been adopted for the work is illustrated in drawing 4610 (Pl. 89), herewith.

The scheme of illumination contemplates the use of range lights to establish direction on the longer tangents and of side lights spaced about 1 mile apart to mark each side of the channel. The range lights are omitted in the cut, where the use is hardly practicable, and on four of the shorter tangents throughout the rest of the canal. A light and fog signal on the west breakwater in Limon Bay is also included, and a light on the east breakwater, should it be built. Gas and nun buoys will also be placed to mark the channel to the Mount Hope dry dock.

Three types of lighted beacons will be used and are illustrated in drawings 4600, 4601, 4611, and 4612 (Pls. 90, 91, 92, and 93) herewith. All are to be built of reenforced concrete. The more elaborate structures are adopted for use on the Gatun locks and dam and in the Atlantic and Pacific divisions, where they are closer to the sailing lines of the vessels, while simpler structures are to be placed in the Gatun Lake, where they are under less close observation.

The project contemplates the construction of 12 tower beacons, type A; 22 tower beacons, type B; 57 beacons, type C; 57 gas buoys, 76 spar buoys, and 7 nun buoys. Reference targets for marking the ranges where lights are not used and for referencing the location of the gas buoys will also be constructed.

The sailing lines marked by the range lights, except at the entrances to the canal, will be so placed that all ships will follow a course 125 feet to their starboard of the axis of the canal; thus, two passing ships, if on their ranges, will have their center lines 250 feet apart.

For the purpose of locating and referencing the gas buoys and for providing an unrestricted view of the range and reference targets, it will be necessary to clear about 1,000 acres of land. This work was in hand at the close of the fiscal year, 373.5 acres having been cleared since the work was begun on April 20. In addition, 148,000 feet of trochas were cut and 16,000 linear feet of profile were taken.

Besides the preparation of the general project, maps for the preliminary work of clearing land and locating beacons and buoys were prepared in the office. The general designs of the different types of beacons were made and drawings of the forms to be used in construction were in hand at the close of the fiscal year.

#### EFFECT UPON LOCK GATES OF DIFFERENCE IN DENSITY OF WATER ON THE TWO SIDES.

In the course of the design of the lower portion of the lock flights at Miraflores and Gatun it has appeared that the gates, upon the two sides of which the water may have different densities, may, with the position adopted for the culverts, be exposed, after the flow through the emptying culverts has ceased, to pressures on the upstream side, which would prevent the possibility of opening the gate or, even under possible conditions, to pressures on the downstream side which would expose the opening apparatus to reverse stresses. A discussion of this subject by Mr. S. H. Woodard will be found on pages 179 and 180 of the Report of the Isthmian Canal Commission for 1899-1901.

It has also appeared that the rise and fall of the tide, especially at the lowest lock leading to the Pacific Ocean, might occasion trouble at the lower gates of the lock if combined with carelessness on the part of the operating force. Thus, if the lower operating gate and lower guard gate should be both shut, with the lower lock filled, on a rising tide, the water outside the lower guard gates might rise, leaving the water in the space between the lower operating and guard gates at a lower level than either the water in the lock or the water outside, thus interposing difficulty in the operation of the guard gates, or, further, were the lower gates of the lock to be shut and the guard gates open, with the lock itself at its low level on a rising tide, reverse pressure would be produced on the operating mechanism of the lower gates.

After preliminary investigation by a committee appointed in this subdivision of your office further study of these matters was committed by you to a board, which gave them much thought and verified certain of its conclusions by experiments.

Analysis indicates that it is possible to find for a given condition of density, depth of water, and location of culvert, an elevation for the outlets of the culvert, with which there will be no resultant unbalanced pressure on the gate leaves, due to difference in density of water on the two sides after flow through the culvert has ceased. Applying the analysis to the known conditions at the lower gates at Gatun and Miraflores, the board determined positions for the outlets of the culverts and recommended that the outlets be placed at these elevations in the horizontal plane of the roof of the culvert, the flow of the water thus being directed upward.

It also expressed its opinion that there was no necessity to provide for pressures due to tidal action otherwise than to place valves in the lower guard gates, these valves being habitually open, and to apply to the lower operating gate an alarm device which should give early notice so soon as a rising tide should produce reverse pressures on the maneuvering mechanism of these gates. As a result, a design for the outlet of the culverts at the lower Gatun and Miraflores locks has been adopted, which it is believed will obviate all serious trouble.

In line with the report of the board, experiments were undertaken in the Atlantic division, under the direction of this office, to determine the effect upon the flow through a given culvert of turning its discharge vertically, through openings in the roof, and especially to determine what size should be given to these openings in order that the theoretical discharge through the culvert, with free opening in a vertical plane, should be reduced as little as possible. The experiments were also extended to include the effect upon the discharge through the same culvert of placing the intakes, as well as the outlets, in the horizontal plane of the roof, thus simulating the conditions of filling and emptying one of the locks of the Panama Canal through the openings in the lateral culverts under its floor. These experiments are now pending, but have been carried sufficiently to indicate approximately the size which should be given to the discharge openings at the lower ends of Miraflores and Gatun lock culverts.

The experiments have practical importance for the reason that, while it would be readily possible to make the openings large enough not to cramp the discharge in any serious degree, it is nevertheless objectionable to make them too large, since, with increased horizontal area, there will be more danger of a current being set up of salt water going in at one part of the opening and fresh water coming out at another.

The matter is of some professional interest, inasmuch as, while the existence of the possible difficulties has been recognized in theory, this is the only instance, so far as the writer is aware, in which the sizes of the gates, the depth of the water, and the positions of the culverts are such that the pressure which may arise, due to difference in densities of water on the two sides, becomes large enough to cause inconvenience. Formulæ for the intensity of the pressure, as submitted by the committee in this office which studied the matter (Exhibit 2), as well as the report of the board subsequently appointed by you, are appended hereto. (Exhibit 1 and appendixes.)

Respectfully,

H. F. HODGES,  
*Assistant Chief Engineer.*

Col. GEORGE W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

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EXHIBIT 1.

NOVEMBER 16, 1910.

Col. GEORGE W. GOETHALS,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

SIR: The board appointed by your letter of July 12, 1910, to consider and report what special means, if any, are needed at the gates near the lower end of the Gatun and Miraflores lock flights to obviate

dangers resulting from tidal action and from the difference of density above and below the locks, has the honor to submit the following report:

The possibly dangerous effect of difference in density above and below the lower gates of a lock separating salt and fresh water was discussed in Mr. Woodward's study of locks for the Nicaragua and Panama routes on pages 189-190 of the Report of the Isthmian Canal Commission for 1899-1901. In extension of that discussion analysis has been made of the theoretical effect on the gates of the Panama Canal as now designed of the difference in density of the waters above and below and of the tidal oscillation. This analysis was made by a committee formed in the first division of your office, and the results indicated a possibly dangerous effect both from tidal oscillation and difference in density.

The board has studied carefully the analyses of Mr. Woodward and of the above-mentioned committee, and has found their conclusions correct under the assumptions made.

The committee states that—

A fall in the tide, either at Gatun or Miraflores, may produce pressure on the upstream side of the lower guard gates when closed. It will do so if the lower gates are also closed, or in case they are open, if the adjacent Stoney valves in the side and center walls are closed. A rise in the tide may produce a pressure on the downstream side of the lower and middle gates in the lower and intermediate locks at Gatun, and of the lower gates in the lower lock and the lower and middle gates of the upper lock at Miraflores. Such pressure will occur in the case of any of these gates, all gates below it being open, whenever the tide rises higher than the level in the chamber just above the gate, if the lock gates themselves and the Stoney valves at the upper and lower ends of this chamber are all at the same time in the closed position.

In order to obviate the pressures resulting from tidal oscillations, the committee proposed introducing auxiliary culverts in the side walls, around those gates which might be exposed to such pressure. In case of the operating gates, these culverts would have to be large enough to regulate the level in the entire chamber of the lock above, and to allow it to follow the tide without the accumulation of a noticeable head outside the gate. The construction of these large auxiliary culverts would involve considerable expense and complication in design. In the board's opinion such expense and complication would not be justified in order to guard against an evil which may be eliminated entirely by proper care in operating the lock. Tidal reverse pressures against the operating gates can not exist unless the valves and gates at the lower ends of the chambers exposed are simultaneously left closed during rise of the tide, the lock itself being at the low level. Habitually, the lower operating gates and valves, will be left open when the water in the lock is at the low level and, in case through carelessness this should not be done, a simple device can be introduced into the working mechanism of the gates which shall give warning so soon as any reverse pressure shall come upon the leaf. In case of the lower guard gates the situation is somewhat different. They will be left closed habitually in order to preserve communication across the lock. When the lower lock is full, and the lower operating gates are necessarily closed for some time, a falling tide might cause reverse pressure to develop from the water in the space between the guard and operating gates. This

danger can be obviated, either by leaving the guard gates ajar or open at such times, or by putting valves in them, these valves to be kept habitually open and to be closed only when the lock is to be pumped out for examination. The valves need not be large, as they regulate only the small chamber lying between the operating gates and the guard gates. The board believes, therefore, that it is unnecessary to modify the masonry in order to obviate dangers from tidal action near the lower end of the lock flights. The introduction of the tell-tale device and of the valves in the guard gates is now under consideration by your designing force.

The possible effect of the difference in density of the water on the two sides of the gate is not so easily avoided. The theory involved is briefly stated in the report of the committee, as follows:

If the water above and below a closed gate differs in density and free communication is opened between the two sides through culverts, the level on one or both sides will generally be changed. If the cross sections of the culverts are not too small, an adjustment of levels will be rather promptly reached and, unless the gates are opened, the levels will change but slowly after this and only by diffusion and current action. The levels reached will depend on the densities and the elevation of the communicating culverts.

The effect on the gates of any difference in level will be to produce a resultant pressure, which may act on either the curved or the straight side.

In the first case, this pressure will increase the force needed to open the gate and it may be greater than it is desirable or possible to overcome; in the second case, the strut, the mitring device and its connections, as well as the gates themselves, may be overstrained by direct pressure, even when the gates remain closed.

Investigation shows that for all the gates involved, the regular system of culverts, if used for connecting the levels, will produce resultant pressures resisting the opening of the gates. Furthermore, in the case of all the gates, there are tidal stages, at which these pressures are considerably greater than desirable if we assume a degree of saltness above and below the gates, such as are quite certain to occur in actual operation.

The pressures mentioned in the above extract from the committee's report result from the fact that flow in the culverts will cease when the unit pressures at the level of the culverts are the same on both sides of the gate. These unit pressures will be equal when the total weight of the columns of water above the culverts is the same on both sides of the gate. If the waters differ in density, the column of heavier water will be less in height than the column of lighter water. In the expression for the total pressures on each side of the gate, the heights of these columns enter in the second power, whereas in the expression for the unit pressure at the culvert level they enter in the first power only. As a result, therefore, when the unit pressures at the culvert level are equal, and flow through the culvert ceases, the total pressures on the two sides of the gate may be unequal and may cause the difficulties which the committee fears.

As the lower gates at Gatun and Miraflores will often be left open, the lowest lock may become filled with water at a different density from that in the lock next above, and the effect feared by the committee might under these circumstances be felt in the upper gate of the lower lock, and even in extreme cases at the intermediate gate of the lock next above.

For a fixed difference in level of the pools and for a fixed difference in density of the waters, a position for the culvert can be found at which, when the unit pressures on both sides of the culvert en-

trance are the same, and flow therefore ceases, the remaining pressure on the gate reduces to zero. In seeking for a remedy for the anticipated difficulties, the committee proposed a system of additional culverts in the side walls at all of the gates where trouble might occur, these additional culverts being placed at such level that, when flow through them should cease, the resultant pressure on the gate would be reduced to a force which could readily be overcome by the maneuvering apparatus proposed for the gates. Accepting the committee's plan, there would then be two sets of culverts, viz, the regular operating culverts, closed by Stoney valves, and the smaller culverts at the higher level closed by auxiliary valves. Were the valves in both these systems to be kept open after the water levels had been nearly equalized there would, in theory, be a continuous circulation, the heavier water coming in from the outside through the lower culvert, and the lighter water going out through the higher culverts, and equilibrium of pressures on the gate would not be established until the water in the lock should reach the same density as the water outside.

So far as it was able to do so, the board confirmed this theory by experiment. A description of this experiment will be found in Appendix A to this report. To obviate this circulation, and at the same time to produce the desired reduction of pressure on the gate, it would be necessary to close the valves in the lower culvert before flow should cease, and to allow the final equilibrium to be established through the higher culverts. At the time when the unit pressures would be equal at the high-level culvert, there would manifestly be a reverse pressure on the valves in the lower or main culverts. Such a reverse pressure would necessitate a totally different design from that already adopted for these valves, or a second set of valves to meet it. The construction of the auxiliary culverts and valves proposed by the committee, and the probably necessary addition of reverse valves in the large lower culverts would add very greatly to the complexity of the design of the gate buttresses, and increase correspondingly the expense of construction. An approximate estimate indicates that the additional cost involved would be about \$235,000 at Gatun and \$165,000 at Miraflores, without considering the cost of the reverse valves.

The board does not regard the cost as the only reason for not adopting the plan, but is desirous of avoiding, under any circumstances, the complexity of design and operation and the additional weakening of the masonry which such auxiliary culverts with their valve chambers and operating mechanism would necessarily involve. The board has, therefore, sought earnestly to find some method of meeting the situation which would not carry such objections with it. It has been unable to find examples of any locks where the pressure on the gates, which theory shows to exist, has proved of practical importance. There are, however, no examples where the conditions approximate in severity to those on the Panama Canal. The most nearly parallel case which the board has been able to find is the Manchester Canal, where the waters on the different sides of some of the lock gates may be of different densities and a certain amount of pressure should, in theory, result.



Mr. W. H. Hunter, the chief engineer of that canal, states in a letter written in answer to inquiry on this subject that:

At Latchford locks, which are 21 miles from Eastham locks and which form the limit of tidal penetration, the conditions are of infinite variety. \* \* \* The measure of the degree of salinity varies below the locks from 160 grains to 980 grains<sup>1</sup> per gallon, while above the locks the variation is from 14 grains to 120 grains per gallon.<sup>2</sup> In these variations it is absolutely impossible to detect any difference in the resistance to the movements of the gates. Having said this, I need hardly add that no special device exists for overcoming any difficulty, real or imaginary, which might be alleged to be due to the difference in density of the water.

It should be stated in this connection that the gates and lifts of the Manchester Canal are smaller than in the Panama Canal, and that the culverts through which the lock empties itself are at a relatively higher level. With the densities given by Mr. Hunter, the theoretical pressure on the gate would be small. It would, however, be noticeable, and should be detected in maneuvering the gates, if it exists.

By a series of observations made through the third division of your office, it has been established that during the rainy season the water below the lower gates, both on the Atlantic and Pacific sides, may be expected to attain practically full salinity unless a considerable volume of fresh water is constantly poured into it. Such a volume would undoubtedly be derived from a continuous series of lockages, if the traffic should be sufficiently large. Whether the lockage water would form an intimate mixture with the salt water below the lock, reducing the salinity temporarily, or whether the lighter water would flow off downstream in a relatively thin stratum, leaving the main bulk of the water below the lock at approximately full salinity, the board is unable to determine. An endeavor was made to obtain data on this subject by pumping fresh water into salt water over the spillway dike, by means of one of the suction dredges. The result of this experiment, while not conclusive, did not indicate that the mixture would be intimate, but rather that the fresh water would remove itself without materially affecting the mean density of the water into which it flowed. This would lead to the belief that at the lower end of the flight the fresh water might escape to the sea without mixing intimately with the salt water first below the gates.

The board has received information to the effect that at the lock leading from the salt water of Charles River at Cambridge, Mass., to the fresh-water basin lying on the other side of the Craigie Bridge and Dam, it has been observed that in locking from fresh to salt water the lock full of fresh water is replaced with a rush by salt water as soon as the gate between the two is opened; and that in the reverse operation the lock full of salt water escapes as a body into the lighter fresh water of the basin so soon as the upper gate separating the waters is opened. In this case, however, the lock lies immediately between two much larger bodies of water without intermediate reach of narrow canal. The change in density might therefore be expected to occur more nearly at once, and, so to speak, through a vertical plane, rather than gradually and through the intervention of a stretch of canal in which the waters are more or less intimately mixed and the flow from fresh to salt water is con-

<sup>1</sup> 1.016. specific gravity.

<sup>2</sup> 1.0008 to 1.007 specific gravity.

tinuously kept up so that change of density takes place gradually instead of at once. The board is therefore of opinion that in the case before it the lower locks of the flights at Miraflores and Gatun will contain relatively a small percentage of salt water at the time when a boat has passed in at sea level and the gates are closed behind it. The percentage of salt water will be largely reduced by the accession of fresh water used in raising the water in the lock to an equalizing level with that in the lock next above. Should the percentage of salt water still remaining be objectionable in practice, which the board does not anticipate, a delicate adjustment of pressures on the gates may readily be made by drawing down an additional small amount of fresh water into the lower lock through the culverts in the middle wall, from the upper lock at Gatun, or the small lake at Miraflores, as the case may be; it being understood that in this process the valves controlling the connections between the middle culvert and the lock next above the gates in general will be in a closed position.

For these reasons the board is of the opinion that it would be safe to omit all precautions with reference to differences of density, except at the lowest operating gates in each flight.

The board has sought for some simple means of meeting conditions at these gates. It has considered the possibility of freshening the water below the gates by auxiliary channels exterior to the lock system, and is not without belief that such measures might prove adequate. It seems, however, that a still simpler expedient will give satisfaction. It has been stated that, in theory, a level for the discharge culvert can be found at which the effect of difference in salinity at the two sides of the gates may be reduced to a manageable amount, or even to zero, with unchanging conditions of density and lift. By an analysis, which accompanies this report as Appendix B, it can be shown that with a range of tide, such as is experienced at Gatun, a position for the culvert can be found at which the maximum resultant pressure on the gate will be less than 1 ton. At Miraflores, where the tidal range is so much greater, a position for the surface of contact of the salt and fresh water, i. e., for the discharge opening of the culvert, can be found at which the maximum resultant pressure will be well within the strength of the operating mechanism.

With the discharge opening in a vertical plane, it is obvious that different conditions as to density would exist at the top and bottom ends of the vertical diameter of the opening, and it might be possible for water of greater density to be flowing inward at the bottom of the culvert and at the same time fresh water flowing out at the top. If, however, the openings are in a horizontal plane, it is believed that this contingency will be practically avoided.

The board proposes, therefore, that below the lower valves the culvert be turned upward to discharge through openings in a horizontal plane, the position of this plane being fixed for the two lock flights at the positions established by the analysis, i. e., at elevation -21 at Gatun and at elevation -25 at Miraflores. The discharge of the culvert will then be at nearly the position of theoretical equilibrium of unit pressure, so that any resultant flow from one side to the other, due to difference in density of the water, can be at first only slight. At the same time the resultant pressure on the gate will be

within manageable limits. With such a position for the discharge, the gush of relatively fresh water will be directed vertically, and will doubtless freshen to the full extent the water lying above its level and within the chamber under the bridge at the end of the lower wall, into which it discharges. The heavier salt water will be below the level of the mouth of the culvert and will not for some time find its way into the opening, leaving ample opportunity to open the gates. After a time, doubtless, the salt water brought up by tidal action will rise above the horizontal plane of the opening of the culvert and it may then begin to effect a circulation from one opening to another of the culvert, thereby bringing some salt water into the lower lock and establishing pressure on the gates. This condition, however, can exist only if the lower gates should be left closed and the valves open for a considerable time after equilibrium has been established. The board believes it to be too remote to be worth guarding against. Even should it exist, it could be relieved without difficulty by bringing down an additional lockage prism from the lock next above.

Sketches have been made, accompanying this report, of different methods of forming the culvert at the discharge end. (Pls. 94-97.) The board is of the opinion that this feature of the design should be worked out in detail in the usual manner in the first division of your office, premising only that the design should be such as to utilize existing form material as much as possible.

While no accurate estimate of the cost involved in this construction can be made until after the design has been perfected, a rough estimate indicates that it will involve about 2,500 cubic yards of additional concrete for each lock flight.

In order to avoid interfering with the efficiency of discharge, the openings in the horizontal plane through which the water escapes from the culvert should manifestly be larger in area than the minimum area of the culvert itself. The board is not prepared to state what proportion these areas should bear to each other, and suggests that this matter should be made the subject of experiment.

No necessity exists for taking any precaution whatever at the outlets of the middle wall, since the existence of the cylindrical valves makes communication from the exterior water to the lock chamber impossible through these culverts, unless it be desired that such communication be established.

Respectfully,

H. F. HODGES,  
*Chairman of Board.*  
CHESTER HARDING,  
*Member of Board.*  
JOHN M. G. WATT,  
*Member of Board.*

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#### APPENDIX A TO EXHIBIT 1.

##### DESCRIPTION OF EXPERIMENT MADE WITH "U" TUBE.

The following is a description of experiments made with a U tube in connection with the study of the conditions existing at the lower gates of the locks due to the difference in density of the water on two sides of the gates:

The apparatus used consisted of pipes 1 inch inside diameter assembled in the shape of the letter U, the legs of the U being about 32 feet long, with glass water gauges inserted at distances of 30 feet on one leg and 15 feet on the other, above the bottom connection between the legs. Additional glass gauges were inserted in both tubes at a distance of  $22\frac{1}{2}$  feet above the bottom connection. About 13 inches below the 30-foot mark an additional connection between the tubes was made, a glass tube with valves being also inserted in this connection. The two legs of the U could be separated or thrown together at will by means of a valve inserted in the bottom connection.

The following experiments were conducted:

First. The valves connecting the tubes were closed. One pipe was filled with sea water to the 30-foot mark and the other pipe was filled with fresh water to the same elevation. The bottom connection was then opened by turning the valve and the height of the salt-water column decreased, and after a few oscillations the two liquids came to a state of rest, the height of the column on the fresh-water side being higher than that on the salt-water side, indicating an initial excessive pressure at the bottom of the salt-water column, due to the greater density of the water therein. The relative heights of the columns remained for a period of about 72 hours the same as immediately after the adjustment, indicating that the salt and fresh water did not appreciably mix during that time.

Second. The salt-water column was filled to the 30-foot mark, the connections between the two tubes being closed, and the fresh-water column to the 15-foot mark. As soon as the connecting valve at the bottom of the tube was opened the salt water column descended and the fresh-water column ascended to approximately the  $22\frac{1}{2}$ -foot mark, the fresh-water column being somewhat higher as in the first experiment. In this case also there was no indication for a considerable period of time of any tendency of the fresh and salt water to mix. Salt water was drawn from the bottom valve on the fresh-water side, indicating that the salt water had pushed the fresh-water column bodily upward without intermingling therewith.

Third. The two columns were separated from each other as before by means of the valves. The fresh water was mixed with a small proportion of red ink so that its motion could be readily followed through the glass tubes. The two columns were filled, one with salt water and the other with the colored fresh water to heights which would produce equilibrium under the assumptions made as to their relative densities. The bottom connection was then opened when there was a very slight change in elevation of water in the two columns due to errors in the assumed density. As soon as equilibrium was produced the valve in the connection near the top of the apparatus was opened. Fresh water, as indicated by its coloring, immediately began to flow through the upper connection from the fresh-water side to the salt-water side. It descended the salt-water column with an appreciable current, and there was an evident circulation from the fresh-water side through the upper connection down the salt-water column back to the fresh-water column through the lower connection, etc., until the water in the two columns appeared to be of the same color.

The conclusions drawn from the above-described experiments are:  
First. That under the conditions named there was no tendency of the salt and fresh water to mix.

Second. That the theory with reference to the effects of water of different densities on the two sides of the gate is correct, and—

Third. That equilibrium of pressure can not be produced on the two sides of the gate with two communicating culverts at different elevations until the circulation developed has had time to make the water on the two sides of the gate of the same density.

#### APPENDIX B TO EXHIBIT 1.

NOVEMBER 9, 1910.

*Memorandum for board on density investigation regarding depth at which theoretical surface of contact between salt and fresh water should lie in order to reduce pressure on gate.*

Formulæ:

$$(1) \quad h_1 = \frac{y_2}{y_1} (h_2 - d) + d$$

$$(2) \quad P = \frac{62.5}{2} L (y_1 h_1^2 - y_2 h_2^2)$$

$y$  = density above gate.

$y$  = density below gate.

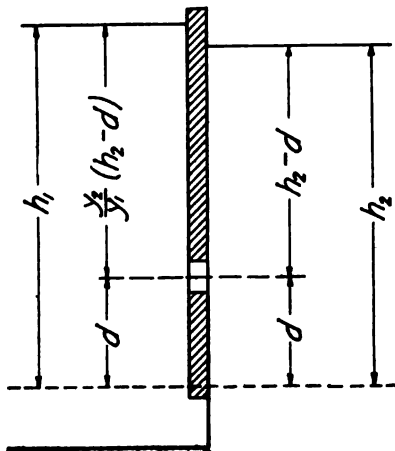
$h_1$  and  $h_2$  = heights of columns of water above and below gate when flow through culvert ceases.

$d$  = vertical distance from culvert center to sill.

$L$  = length of gate.

$$\frac{62.5}{2} L = 1,970$$

$P$  = total pressure on leaf.



Assume density below gate at 1.020, above gate as 1.000. Then, for  $P=0$ ,

$$y_1 h_1^2 - y_2 h_2^2$$

must reduce to zero.

$$\text{Hence } h_1^2 = 1.020 h_2^2.$$

At Gatun at mean tide,  $h_2 = 42$  feet. Hence,

$$h_1 = \sqrt{1.020 \times 42^2} = 42.42$$

From equation No. 1,  $42.42 = 1.020 (42 - d) + d = 42.84 - 0.020 d$ . Hence,  $d = 21$ , or, the surface of contact should be at reference  $-21$ , in order to reduce pressure on gate to zero.

If the density below the lock be taken at 1.010, instead of 1.020, we have,

$$h_1 = \sqrt{1.010 \times 42^2} = 42.21 = 42.42 - 0.01d$$

Hence,  $d = 21^1$ , as before.

At mean tide, therefore, the proper position for the surface of contact, theoretically, is at reference  $-21$ . At high tide this position will result in some pressure on the gate.

Taking  $h_2$  as 43, which represents high tide below Gatun, and assuming the surface of contact to be at  $-21$ , we have

$$h_1 = 1.020 (43 - 21) + 21 = 43.44 \text{ and}$$

$P = 1,970 (43.44^2 - 1.020 \times 43^2) = 1,970$  pounds, a trivial resultant pressure.

If the water inside the lock be 1.010 density, instead of unit density, the theoretically proper position for the surface of contact may be found in a similar manner.

We have then,

$$h_1 = \sqrt{\frac{1.020}{1.010}} \times 42^2 = 42.21,$$

and

$$42.21 = 1.0099 (42 - d) + d = 42.416 - 0.0099 d.$$

Hence,  $d = 20.8$  feet; from which it appears that the elevation of the surface of contact at  $-21$  for Gatun is right, under varying conditions of density and at any stage of tide.

At Miraflores at mean tide  $h_2$  is, say, 50 feet.

Assume the densities as 1.000 and 1.020. We have, therefore,

$$h_1 = \sqrt{1.020 \times 50^2} = 50.50,$$

and

$$50.50 = 1.020 (50 - d) + d$$

Hence,  $d = 25$ .

Similarly, with  $h_2$  at 60,  $h_1$  becomes equal to 60.60, and  $d$  to 30; with  $h_2$  at 40, i. e., the condition of low tide,  $d$  becomes 20. The value of  $d$  at 25 is, therefore, intermediate between the high-water and the low-water values.

Assuming the density as 1.010 and 1.020, respectively, we have,

$$h_1 = \sqrt{\frac{1.020}{1.010}} \times 50^2 \text{ at mean tide,}$$

Whence results the value of  $d=25.25$ .

The reference of the surface of contact as  $-25$  is, therefore, right for widely varying densities. Assuming the surface at this reference, we have at high tide, in equation No. 1, with densities of 1.020 and 1.000,

$$h_1 = 1.020 (60 - 25) + 25 = 60.70,$$

and

$$P = 1,970 (60.70^2 - 1.020 \times 60^2) = \text{say, } 24,000 \text{ pounds.}$$

At low tide,  $h_2 = 40$ .

$$h_1 = 1.020 (40 - 25) + 25 = 40.30.$$

$$P = 1,970 (40.30^2 - 1.020 \times 40^2) = 1,970 (1624 - 1632) = \text{say, } -15,760 \text{ pounds resultant pressure.}$$

## EXHIBIT 2.

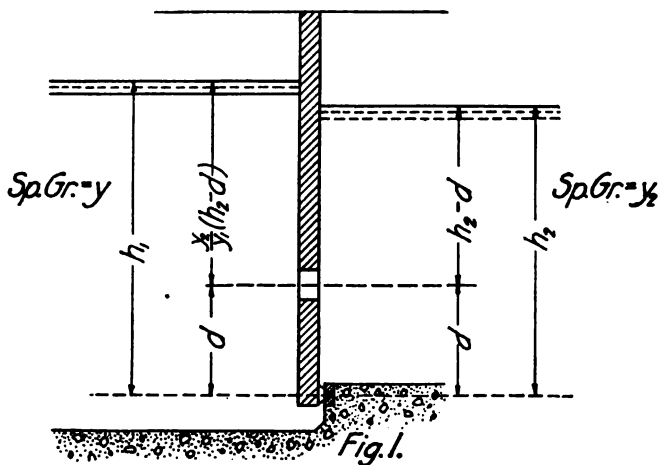
CALCULATION OF THE FORCES ACTING ON MITERING LOCK GATES AS THE RESULT OF A DIFFERENCE IN DENSITY IN THE WATER ON OPPOSITE SIDES OF THE GATES.

In case of such a difference of density, if a free connection between the water above and below the gates is established through culverts, a flow will generally take place which will continue until the water reaches a certain level on each side of the gate. With culverts of practical dimensions this stage will be rather quickly reached, and subsequent changes in relative level will be extremely slow and need not be further considered.

The levels obtained and the effect on the gates will vary with the relative densities of the water, the height of the gates, and the elevation of the communicating culverts.

The difference of level may produce (a) a force resisting the opening of the leaves, or (b) a force tending to open the gates.

Let figure 1 represent a cross section of a gate, showing also an opening through the gate, at a height  $d$  above the sill.



Let  $Y_1$  and  $Y_2$  be the specific gravities of the water above and below the gate and  $h_1$  and  $h_2$  the depths of water after equilibrium has been established.

It can readily be seen that

$$h_1 = \frac{Y_2}{Y_1}(h_2 - d) + d = n(h_2 - d) + d \text{ if } n = Y_2/Y_1$$

If, further,  $L$  = the length of the gate leaf, the total force acting on the leaf will be given by the equation

$$P = \frac{62.5}{2} L (Y_1 h_1^2 - Y_2 \times h_1^2).$$

If  $d$  is measured upward from sill level it will be a positive quantity in the above equations, otherwise it will be negative.

If, in place of an opening through the leaf, there is a culvert in the masonry, it is less easy to fix a proper value of  $d$  for use in the above equations. Immediately after an outward flow of the less dense water the point of equilibrium will probably be at the level of the outlet into the lower chamber. In case this outlet is higher than other portions of the communicating channel, some of the denser water may flow into the culvert and the point of equilibrium will then drop, changing the value of  $h_1$ .

Hence, in case the entire connecting culvert is not at the same level, it is necessary to compute  $h_1$  and  $P$  for the most unfavorable conditions.

The correctness of the expression  $P$ , given above, can not be questioned, the only point arising as to the proper values of  $Y_1$  and  $Y_2$  and  $d$  to be selected, in any given case.

The following computations give for Gatun and Miraflores: (1) The values of  $h_1$ ,  $h_2$ , and  $P$  for the existing culvert designs; (2) with certain culverts added in order to reduce  $P$  and  $h_1 - h_2$  to safer limits.

#### GATUN LOCKS.

##### LOWER GATE, LOWER LOCK; AND MIDDLE GATES, LOWER LOCK.

As designed, the center of the culvert in the side wall is at elevation  $-38$ , while in the middle wall it is at  $-42$  at the outlet. The center of laterals (inlets) is at elevation  $-50$ , this being the lowest central point in the conduit connecting the two locks.

*Case 1, tide level at elevation  $+1$ .*—Water in lower lock and canal below the same to level  $+1$  is assumed as having the specific gravity of sea water or  $y_2 = 1.027$ .

If fresh water is added to bring the water in the lower lock to elevation  $+30$ , then the specific gravity of the water in the lower lock changes to

$$y_1 = \frac{1.027 \times 45 + 29}{74} = 1.016$$

and

$$n = \frac{y_2}{y_1} = \frac{1.027}{1.016} = 1.011.$$



The mixture will probably be very thorough, owing to the nature of the culverts. We have, then—

(a) Keeping only the culvert in the side wall open, and assuming equilibrium at the center of the outlet at elevation  $-38$ , we have  $h_2=45'$  and  $d=6'$ .

Then  $h_1=1.011(45-6)+6=45.43'$

$$P = \frac{62.5 \times 63}{2} (1.016 \times 45.43^2 - 1.027 \times 45^2) = 1,970(2,097 - 2,079) = 35,460 \text{ pounds. Resisting opening.}$$

(b) Keeping only the culvert in the middle wall open and assuming equilibrium at the center of the outlet, i. e., at elevation  $-42$ .

Then  $d=2'$  and  $h_2=45'$

$$h_1 = 1.011(45-2)+2=45.47$$

$$P = 1,970(1.016 \times 45.47^2 - 1.027 \times 45^2) = 1,970(2,100 - 2,079) = +41,370 \text{ pounds. Resisting opening.}$$

(c) If in the case of either culvert we assume equilibrium to take place at the center of the laterals, i. e., at elevation  $-50$  feet,  $d = -6'$  and  $h_2=45'$ .

Then  $h_1=1.011(45+6)-6=45.56'$

$$\text{and } P = \frac{62.5 \times 63}{2} (1.016 \times 45.56^2 - 1.027 \times 45^2) = 1,970(2,109 - 2,079) = +59,100 \text{ pounds. Resisting opening.}$$

The values for  $P$  are too high, bringing stresses of about 110,000 pounds and 160,000 pounds on the operating strut.

*Case 2, tide level at  $-1$ .*—This would give somewhat lower values than those given above.

#### LOWER GATES; INTERMEDIATE LOCK.

*Case 1, tide level at elevation  $+1$ .*—One thousand and eighty foot chamber in the intermediate lock equated with 1,080 feet in the lower lock. The equating of levels will take place at about elevation  $+30$ .

Hence, we have below the gate the following mixture:

Salt water	$45 \times 1.027 = 46.21$	
Fresh water	$29 \times 1.00$	29.
Total	$\frac{74}{74}$	$\frac{75.21}{75.21}$

$$\text{and } y_2 = \frac{75.21}{74} = 1.016$$

Above these gates the water will be fresh, or  $y_1=1.000$ . Hence,

$$n = \frac{1.016}{1.000} = 1.016$$

The center of the laterals in the lower lock is at elevation  $-50'$ . Hence,  $d = -36$  and  $h_2 = 44$ .

$$h_1 = 1.016 (44 + 36) - 36 = 45.28$$

and

$$P = 1,970 (45.28^2) - 1.016 \times 44^2 = 163,500 \text{ pounds. Resisting opening.}$$

This would evidently produce too great a strain on the machinery.

#### MIDDLE GATES; INTERMEDIATE LOCK:

Seven hundred and forty foot chamber in intermediate lock is equalized with a length of 1,080 feet of lock just below it. This will equalize at  $+25$ .

Hence we have below the gate the following mixture:

Salt water	$(45 \times 740 + 340 \times 15)$	$1.027 = 39436$
Fresh water	$24 \times 1080 \times 100 =$	<u>25920</u>
		<u>65356</u>

Hence,

$$y_2 = \frac{65356}{64320} = 1.016$$

and

$$n = 1.016$$

If the levels balance about the center of the main laterals, we have

$$\begin{aligned} h_2 &= 40 \quad d = -6 \\ h_1 &= 1.016 (40 + 6) - 6 = 40.736 \end{aligned}$$

and

$$P = 1,970 (40.736^2 - 1.016 \times 40^2) = 66,600 \text{ pounds. Resisting opening.}$$

This value of  $P$  is also too large for operation of the gates.

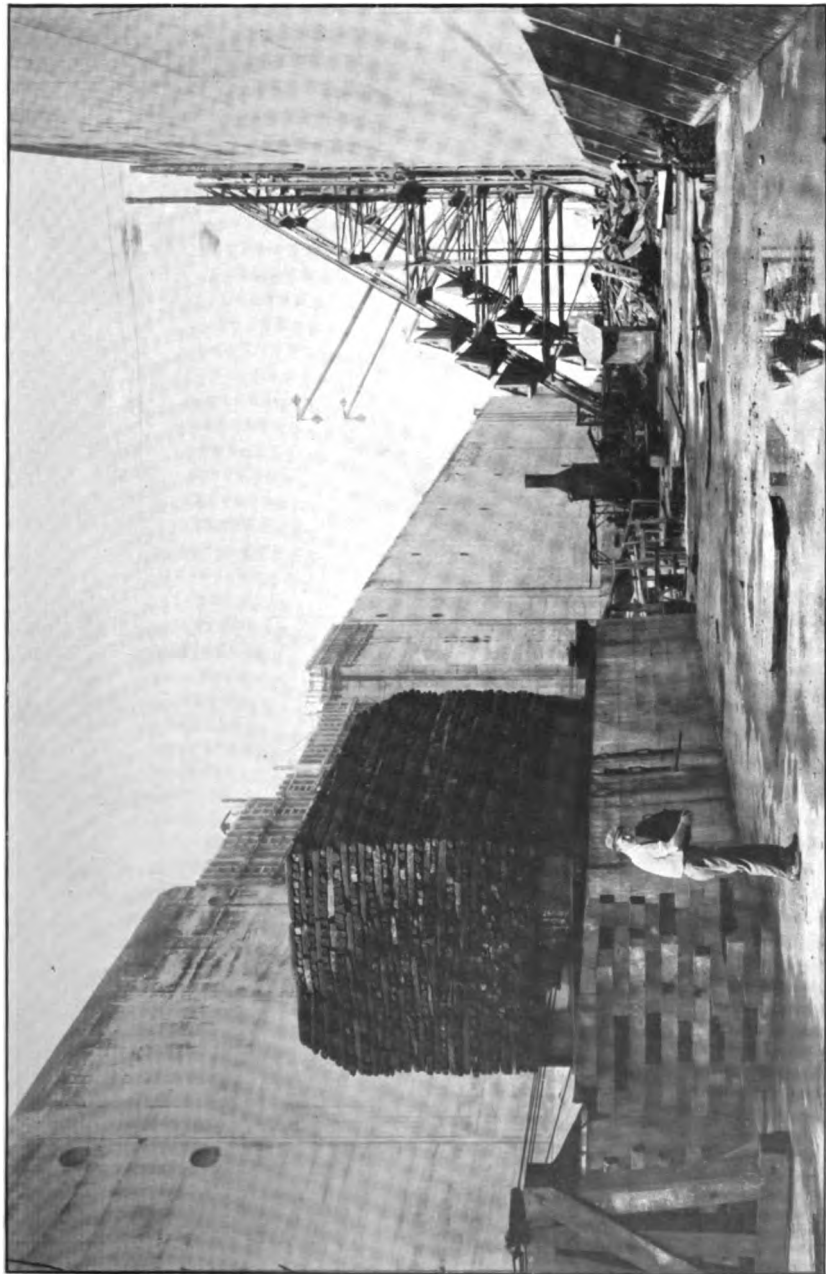
According to these computations, the values of  $P$  will be too great in the case of all the gates in the lower and intermediate locks at Gatun, but will be particularly excessive at the lower gates of the intermediate lock. This last is due to the low position of the outlets in this case.

The assumptions as to saltiness in the lower lock, before locking begins, are likely to hold in case of infrequent locking. If the water in the lower lock is taken as more nearly fresh, before locking, the value of  $P$  for the gates in the lower lock will be very nearly the same as given above. The values of  $P$  for gates in the intermediate lock will be somewhat less than those given. There seems to be no good reason for changing the assumed values of the densities. The only apparent reason for so doing is the possible effect of the flow of water in freshening up the water below a gate.

Owing to the large volume of water to be thus affected and the position of the outlets, it is not believed that any less severe assumption as to  $y_1$  and  $y_2$  should be made.

(Computed by Henry Goldmark, designing engineer, and J. Hammer, assistant engineer.)

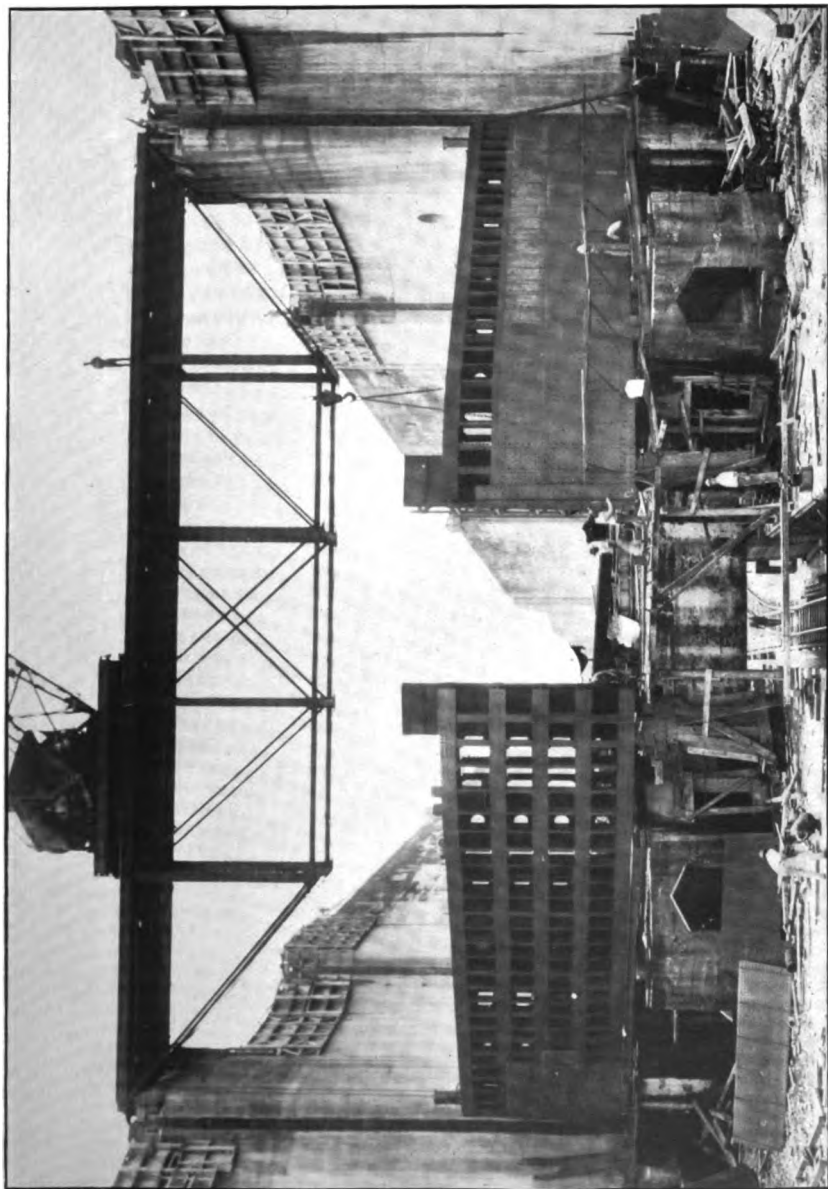




GATUN LOCKS. TESTING STONEY GATE VALVE GATES AT UPPER LOCKS, NOVEMBER 19, 1910.



PLATE 2.



GATUN LOCKS LOOKING NORTH, SHOWING METHOD OF CONSTRUCTION OF UPPER GUARD GATES, JULY 5, 1911.





VANADIUM STEEL YOKE AFTER TESTING TO DESTRUCTION.





## APPENDIX B.

### REPORT OF LIEUT. COL. WILLIAM L. SIBERT, CORPS OF ENGINEERS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, DIVISION ENGINEER, ATLANTIC DIVISION.

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ISTHMIAN CANAL COMMISSION,  
DEPARTMENT OF CONSTRUCTION AND ENGINEERING,  
ATLANTIC DIVISION,  
OFFICE OF DIVISION ENGINEER,  
*Gatun, Canal Zone, July 31, 1911.*

SIR: I have the honor to submit the following report of work done by the Atlantic division, department of construction and engineering, during the fiscal year ending June 30, 1911:

The work assigned to the division remains as described in the report for last year.

The construction work comprised within the division, as shown on the accompanying plate (Pl. 98), is divided into four parts, as follows:

First. That comprising the excavation of the channel between the Gatun locks and the Atlantic Ocean; the procuring and transporting of stone and sand from Porto Bello and Nombre de Dios, respectively, to Gatun; the transportation of cement from Cristobal to Gatun; the operation of the dry dock and shops at Cristobal; and the construction of breakwaters in Colon Harbor; Maj. Edgar Jadwin, Corps of Engineers, United States Army, resident engineer, was in local charge of this work, assisted by Capt. Horton W. Stickle, Corps of Engineers, United States Army, assistant engineer, until June 15, 1911. From June 15, 1911, to June 30, 1911, Maj. Chester Harding, Corps of Engineers, United States Army, assistant division engineer, was in local charge. Prior to that time Maj. Harding was in immediate charge of the designing work of the division and of the division clerical force.

Second. That comprising the construction of the Gatun locks, Maj. James P. Jervcy, Corps of Engineers, United States Army, resident engineer, in local charge.

Third. That comprising the construction of the Gatun Dam and Spillway, Maj. George M. Hoffman, Corps of Engineers, United States Army, resident engineer, in local charge.

Fourth. That comprising municipal engineering work, Mr. Leslie G. Thom, superintendent, in local charge.

## DIVISION OFFICE.

The usual clerical duties were performed in connection with miscellaneous correspondence, reports, cost accounting, pay rolls, and other routine papers.

## DIVISION DESIGNING FORCE.

[Maj. Chester Harding, Corps of Engineers, United States Army, assistant division engineer, in local charge until June 15, 1911. From June 15, 1911, to June 30, 1911, Mr. George M. Wells, office engineer, in local charge.]

The following is a summary of the work done by the division designing force during the fiscal year:

Preparation of drawings to accompany the annual report of the division engineer for the fiscal year 1910-11.

Detailed design and drawings for the Agua Clara sedimentation basin, filtration building, clear-water basins, and chemical laboratory.

Design and details of floors and columns for new commissary building at Cristobal.

Design and details of small experimental mechanical gravity filter.

Design and details of reenforced-concrete piles.

Design and details of two 93-foot steam pile drivers.

Design and details for outer ends of the east and west wing walls of the Gatun spillway.

Design and details of collapsible steel forms for the Gatun lock drainage tunnels.

Design and details for the salt water cut-off for the Gatun power plant.

Design and details of the east cut-off wall at the intermediate gate, Gatun locks.

Design and details of the collapsible steel forms for the operating tunnel at Gatun locks.

Design and details of the suspended arch centering for south flare walls of Gatun locks.

Design and details of 15-ton steel skips for Porto Bello quarry.

Detailed drawings of lock-wall monoliths.

Design and details of modification of 70 cubic foot Brown grab bucket.

Designs and details for north center approach wall, Gatun locks.

Detailed design for reenforced-concrete flare walls north end of Gatun locks.

Detailed design for solid concrete flare walls north end of Gatun locks.

Studies, designs, and general plan for permanent bridge across the spillway channel.

Design and details for 40 and 30 foot 25-ton boom for American Hoist & Derrick Co.'s locomotive cranes.

Design and details of east and west flare walls at south end of Gatun locks.

Computations and layout for proposed high-pressure fire service for Colon and Cristobal.

- Design and details of screening plant.
- Design and details of brakes for the lock cableways.
- Design and details of modifications of cubical concrete mixers.
- Design and details of collapsible steel forms for the manufacture of 20 and 24 inch concrete sewer pipe.
- Design and details for the emergency pumping station.
- Design and details of high-level trestle across lock chamber.
- Modifications and design of operating tunnels for 30 and 40 foot spans.
- Design and details for reenforced concrete timbered buttress dam at north end of locks.
- Details of construction for the operating tunnel and counterweight walls, Gatun spillway.
- Theoretical analysis for efficiency of discharge of the Colon sewerage pumps.
- General 1/5000 map of the division.
- Design and details for bag-pressing machine.
- General 1/5000 map of the division, showing all railroad tracks.
- Design and drawings of aerial barrel conveyer.
- General detailed drawings of spare and repair parts for general division plant equipment.
- During the year approximately 10,000 blue prints were made.

**CHANNEL EXCAVATION FROM GATUN TO THE ATLANTIC OCEAN, COLON BREAKWATER, AND SAND, STONE, AND CEMENT SERVICE FOR GATUN LOCKS AND SPILLWAY, FOR THE YEAR ENDING JUNE 30, 1911.**

[Maj. Edgar Jadwin, resident engineer, in local charge July 1, 1910, to June 15, 1911.  
Maj. Chester Harding, assistant division engineer, in local charge June 15, 1911, to June 30, 1911.]

**EXCAVATION BELOW SEA LEVEL—MINDI.**

[See Plate 98.]

When the cut was flooded as indicated in the last annual report, it was decided to remove by a hydraulic pipe line dredge all of the earth that it was practicable to remove by such means, and to limit the excavation by steam shovel as nearly as practicable to rock. Accordingly, as soon as a dredge was available for the purpose, on October 24, 1910, dredge *No. 86* began cutting her way from the French Canal into the cut, through the barrier that had been left in making the excavation with steam shovel. On November 13, 1910, she was replaced by the dredge *Sandpiper*, which worked until December 29, 1910. These two dredges removed 401,511 cubic yards of earth from the cut.

The opening in the barrier was closed and pumping started January 15, 1911. On February 1, 1911, the cut had been unwatered to elevation minus 36, on which date two 70-ton shovels started work. At the end of the fiscal year 53,199 cubic yards of earth and 227,106 cubic yards of rock had been removed, an average of 24,374 cubic yards per shovel month.

The amount of material removed monthly is shown in the following table:

	Rain-fall.	Canal prism.			Remarks.
		Earth.	Rock.	Total.	
1910.	<i>Inches.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	
October.....		40,168		40,168	Dredged.
November.....		213,997		213,997	Do.
December.....	19.22	147,346		147,346	Do.
1911.					
January <sup>1</sup> .....					
February.....	2.13	* 9,704	37,398	47,102	
March.....	1.85	* 11,325	47,464	58,789	
April.....	6.39	* 19,935	59,445	79,380	
May.....	19.14	* 21,710	42,772	64,482	
June.....	14.72	* 13,159	45,998	59,157	
Total.....		477,344	233,077	710,421	

<sup>1</sup> Pumping out cut.

\* Includes 5,200 cubic yards sluiced.

\* Includes 9,055 cubic yards sluiced.

\* Includes 5,350 cubic yards sluiced.

\* Includes 5,500 cubic yards sluiced.

\* Includes 3,500 cubic yards sluiced.

The average division cost per cubic yard at Mindi was as follows:

Dredging.....	\$0.1280
Dry excavation.....	.6010
Sluicing.....	.2690

About 165,000 cubic yards of rock from Mindi were used at Gatun for back fill, the cost of dumping being charged to the locks.

The total amount of construction track at Mindi on July 1, 1911, was 3.63 miles.

#### LEVEE FOR RETAINING HYDRAULIC FILL NEAR MINDI, EAST OF PANAMA RAILROAD RELOCATED LINE.

The excavation by hydraulic pipe line dredges of material in the canal prism between Mindi and Gatun locks requires the preparation of a space for receiving the dredged material. The most suitable ground for this purpose lies just east of the Panama Railroad relocated line, between Mindi and New Gatun, and in order to keep the fill from interfering with the railroad track it was found desirable to construct a levee east of the track. In the construction of this levee about 5,650 linear feet of trestle were built and filled during the past year, the fill being taken in part from the steam-shovel excavation at Mindi, and the remainder from excavation from the lower lock at Gatun.

#### DREDGING—OCEAN TO MINDI.

[See Plate 98.]

Dredges removed 4,516,369 cubic yards of earth and 487,038 cubic yards of rock from the canal prism. This work was done by the seagoing dredge *Caribbean*, 5-yard dipper dredges *Chagres* and *Mindi*, and the French ladder dredges *No. 1*, *No. 5*, and *No. 6*.

The channel silting for the year was about 2,750,000 cubic yards. The only dredging done on miles 1 to 2 during the year was about 273,667 cubic yards at the south end of mile 2. The total silting in these two miles during this period, as shown by surveys in June, 1910, and June, 1911, was 310,901 cubic yards.

Four hundred and eighty-two thousand five hundred and thirty cubic yards of original earth were removed from mile 3 by the dredge *Caribbean*. The silting for this mile for the year was 902,038 cubic yards.

Surveys made immediately before and after the norther of December 3 to 5, inclusive, showed a fill of about 370,000 cubic yards.

On July 1, 1910, 37 feet of water could be carried from zero to mile 2 plus 00 feet; 30 feet to mile 4 plus 3,900 feet; 20 feet to mile 5 plus 700 feet; 15 feet to mile 5 plus 1,910 feet, the end of the cut.

On July 1, 1911, 40 feet of water could be carried from zero to mile 0 plus 2,200 feet; 37 feet to mile 2 plus 00 feet; 40 feet to mile 3 plus 500 feet; 29 feet to mile 4 plus 500 feet; 23 feet to mile 4 plus 3,200 feet; 30 feet to mile 5 plus 2,000 feet; 22 feet to mile 5 plus 2,438.5 feet P. I.

Forty-six thousand five hundred and forty-one linear feet of drilling was done.

Three hundred and eighty-five thousand eight hundred and forty-seven pounds of dynamite were used.

Three hundred and eighty-two thousand three hundred and twenty-one cubic yards of material were blasted in canal prism and a large amount of dobies used.

Dredge *No. 6* sank in the canal prism on the morning of June 19. Preparations are being made to raise her.

#### DREDGING—MINDI TO GATUN.

The dredge *Sandpiper* removed 423,427 cubic yards of earth from canal prism north of the Gatun locks.

The average division cost per cubic yard, place measurement, for all material dredged in the prism during the fiscal year was 22.15 cents.

#### CRISTOBAL TERMINALS.

Four hundred and forty-two thousand three hundred and fifty cubic yards of earth and 4,853 cubic yards of rock were removed from the channel in front of piers Nos. 11 to 14, inclusive.

#### MISCELLANEOUS DREDGING.

In addition to the above, 5,414 cubic yards of earth and 2,247 cubic yards of rock were removed from the dry-dock slip and 1,400 cubic yards of earth from Shelter Cove; 3,341 cubic yards of earth from Dock 2; 4,542 cubic yards of earth and 10,031 cubic yards of rock from French Canal; 33,742 cubic yards of earth and 6,608 of rock from in front of cement dock at Gatun; 3,197 cubic yards of earth from in front of Dock 3, Gatun.

The total monthly output of all dredges is shown in the following table:

	From canal prism.			From accessory works.			Grand total.
	Earth.	Rock.	Total.	Earth.	Rock.	Total.	
<b>1910.</b>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
July.....	395, 154	27, 838	423, 092	37, 774	4, 020	41, 794	464, 886
August.....	464, 265	44, 564	508, 829	5, 696	0, 529	6, 225	515, 358
September.....	420, 869	31, 004	451, 873	19, 304	7, 140	26, 444	478, 317
October.....	525, 222	24, 566	549, 788	19, 292	9, 499	28, 791	578, 579
November.....	533, 392	67, 316	600, 708	188, 852	.....	188, 852	789, 560
December.....	421, 434	60, 936	482, 370	252, 840	.....	252, 840	735, 210
<b>1911.</b>							
January.....	478, 316	43, 865	520, 181	151, 092	.....	151, 092	671, 273
February.....	416, 086	39, 232	455, 318	92, 094	.....	92, 094	547, 412
March.....	341, 631	50, 105	391, 736	132, 272	.....	132, 272	524, 008
April.....	442, 625	34, 549	477, 174	119, 014	2, 247	121, 261	598, 435
May.....	471, 658	42, 520	514, 178	77, 301	.....	77, 301	591, 479
June.....	431, 655	20, 443	452, 098	97, 149	.....	97, 149	549, 247
<b>Total.....</b>	<b>5, 341, 307</b>	<b>487, 038</b>	<b>5, 828, 345</b>	<b>1, 192, 680</b>	<b>23, 739</b>	<b>1, 216, 419</b>	<b>7, 044, 764</b>

The following table shows the output in the prism by months during the year and the division cost of excavation per cubic yard by the different types of dredges:

Months.	Section dredge (sea-going Caribbean).		Dipper dredges.			
	Output earth.	Cost per cubic yard.	Earth.	Rock.	Total.	Cost.
<b>1910.</b>	<i>Cubic yds.</i>	<i>Cents.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cents.</i>
July.....	292, 272	5. 70	.....	.....	.....	.....
August.....	285, 510	5. 30	65, 212	15, 386	80, 598	80. 60
September.....	273, 702	6. 95	39, 726	8, 622	48, 348	38. 89
October.....	345, 996	4. 58	36, 592	6, 624	43, 216	35. 40
November.....	201, 971	4. 91	46, 486	20, 921	67, 407	30. 59
December.....	195, 585	3. 71	37, 078	23, 943	61, 021	36. 21
<b>1911.</b>						
January.....	239, 360	4. 98	67, 554	9, 957	77, 511	22. 98
February.....	183, 400	. 07	32, 246	3, 326	35, 572	19. 59
March.....	140, 800	18. 25	20, 785	13, 430	34, 215	42. 05
April.....	364, 320	4. 38	19, 467	18, 315	37, 782	46. 97
May.....	356, 943	3. 92	18, 670	15, 423	34, 093	67. 15
June.....	300, 337	5. 01	55, 631	15, 094	70, 725	42. 45
<b>Total.....</b>	<b>3, 180, 196</b>	.....	<b>439, 447</b>	<b>151, 041</b>	<b>590, 488</b>	.....
<b>Average operating cost.....</b>	.....	<b>5. 28</b>	.....	.....	.....	<b>33. 66</b>
<b>Plant arbitrary.....</b>	.....	<b>5. 92</b>	.....	.....	.....	<b>5. 92</b>
<b>Total division cost.....</b>	.....	<b>11. 20</b>	.....	.....	.....	<b>39. 58</b>

Months.	Ladder dredges.				Pipe-line dredge.	
	Earth.	Rock.	Total.	Cost.	Output earth.	Cost per cubic yard.
1910.	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cents.</i>	<i>Cu. yds.</i>	<i>Cents.</i>
July.....	102,882	27,938	130,820	34.68	.....	.....
August.....	101,912	29,178	131,090	33.20	11,631	84.81
September.....	107,441	22,383	129,823	33.84	.....	.....
October.....	102,466	17,942	120,408	39.47	40,168	15.88
November.....	70,938	46,395	117,333	30.28	213,997	8.24
December.....	41,425	36,993	78,418	42.80	147,346	11.07
1911.						
January.....	39,519	33,908	73,427	33.08	129,883	16.76
February.....	21,235	35,906	57,141	41.32	179,205	10.14
March.....	65,707	36,675	102,382	35.67	114,339	21.89
April.....	59,838	16,234	76,072	48.28	.....	.....
May.....	96,045	27,097	123,142	27.67	.....	.....
June.....	75,687	5,349	81,036	37.78	.....	.....
Total.....	885,095	335,997	1,221,092	.....	836,569	.....
Average operating cost.....	.....	.....	.....	35.65	.....	17.26
Plant arbitrary.....	.....	.....	.....	5.92	.....	5.92
Total division cost.....	.....	.....	.....	41.57	.....	23.18

The revised estimate of the original channel excavation between Gatun and the Atlantic Ocean is shown in the following table, which also shows the amounts excavated to date:

Depth, M. L. T.	Mile.		Original excavation.			Amounts excavated to date.					
	From	To	Earth.	Rock.	Total.	Original excavation.				Sifting.	Grand total.
						Earth.	Rock.	To anticipate sifting.	Total.		
41 feet.	0.00	1.00	337,999	.....	337,999	260,027	.....	72,918	332,945	277,187	610,132
	1.00	2.00	908,512	.....	908,512	794,101	.....	488,444	1,282,545	1,399,252	2,681,797
	2.00	3.00	1,802,413	.....	1,802,413	1,573,672	.....	376,984	1,950,656	2,336,920	4,287,576
	3.00	4.00	2,784,817	452,406	3,237,223	1,834,012	323,470	12,335	2,169,817	2,932,215	5,102,032
	4.00	4.55	2,484,957	130,407	2,615,364	1,327,701	.....	1,327,701	2,667,922	3,995,623	.....
	4.55	5.00	1,568,277	776,820	2,335,097	982,814	688,438	2,283	1,673,635	867,570	2,541,205
	5.00	5.46	1,630,876	692,481	2,323,357	1,292,596	288,565	2,354	1,583,415	161,551	1,744,966
	5.46	6.00	1,105,671	1,863,961	2,969,632	858,804	1,290,083	.....	2,148,887	28,605	2,177,492
	6.00	6.946	4,598,381	48,232	4,646,613	442,666	.....	.....	442,666	.....	442,666
Total.....			17,211,903	3,964,307	21,176,210	9,366,393	2,590,556	955,318	12,912,267	10,671,222	23,583,489

<sup>1</sup> Figures will be changed, due to more extensive borings.

#### COLON FILL.

The approved project for the improvement of the city of Colon involves the general raising of the surface east of D Street within the limits of the contemplated improvement by means of dredged material deposited by a pipe-line suction dredge. During the year 698,644 cubic yards of material, borrow-pit measurement, were placed in connection with this work by 20-inch pipe-line dredges.

#### DRY DOCK AND MARINE SHOPS.

The boiler-shop extension was completed, the necessary jib and traveling cranes erected, the power plant improved by the installa-



tion of a condenser, and an oil forge added which handles billets 12 inches square.

During the year 118 boats were docked. Some of the more important work was as follows:

Altering French ladder dredge into 18-inch pipe-line dredge, completed.

Reassembling of 20-inch dredge *Sandpiper* completed.

Built wooden self-dumping barge 150 feet long by 30 feet wide.

Launched one derrick barge.

Lengthened slides on ladder dredge *No. 1*.

Emergency dam for dry dock about 70 per cent complete.

New boom for dredge *Chagres* 92 per cent complete.

Wooden houses replaced by steel on barges *No. 1*, *No. 7*, *No. 9*, and *No. 10*.

#### SURVEYS.

In addition to the usual weekly and monthly surveys the following work was done:

Maps of Margarita and Las Minas bays made in connection with fortification work; maps and borings from Cristobal to Gatun in connection with preliminary layout for permanent terminals at the Atlantic entrance; surveys were also made of Cristobal Harbor, the French Canal, and Nombre de Dios.

#### PORTO BELLO ROCK PLANT.

On June 30, 1911, the quarry face had a length of 2,600 feet and a maximum height of 170 feet.

In blasting operations the same general plan was followed as for the previous year, 60 per cent dynamite being generally used in holes of a maximum depth of 24 feet.

Very soon after the crushing plant at Porto Bello was placed in operation it became apparent that the largest crushers, *No. 9*, were too small for the work to be done. The character of the stone was such that it was very difficult and expensive to reduce it to the proper size for entering the *No. 9* crusher, and it was consequently decided to purchase and install a *No. 21* Allis-Chalmers gyratory crusher with openings 42 inches by 8 feet on each side of the spider arm to overcome the most serious difficulties encountered in operating the original installation.

This crusher, however, was not installed and ready for operation until September 4, 1910. The quarry floor had been developed so as to dump stone directly from cars into the *No. 9* crushers as installed, and this development forced the installation of the *No. 21* crusher at the same level as the *No. 9* crushers. This meant that the material from the *No. 21* crusher had to be lifted back to the elevation of the *No. 9* crushers. This was done by a bucket conveyor.

After the installation of the larger crusher, remodeling the pan conveyors, and laying a heavier track for same, the operation of the quarry has been quite successful. The larger crusher receives stone of the maximum size handled in the steam shovels without difficulty, and, since its installation, dobeying has been dispensed with, the capacity of the plant largely increased, and the cost of producing the crushed stone correspondingly reduced.

The following tables show details of costs of quarry operation, water transportation, unloading and storing rock at Gatun:

*Detailed statement of operations of rock-crushing plant.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Rainfall, in inches..	22.80	20.71	13.15	9.54	23.08	22.89	0.84	6.90	2.38	6.60	19.25	18.00	166.14
Dynamite used, long tons.....	47.21	42.86	34.08	37.10	26.79	26.97	31.92	22.77	28.13	22.77	22.33	22.32	365.25
Drilling, in feet.....	21,840	19,496	19,995	19,584	16,309	19,425	15,140	12,633	15,338	12,758	14,866	14,329	201,303
Maximum days output—													
Hours.....	16	24	16	12	12	12	12	10	8	8	8	8	.....
Cubic yards.....	3,743	4,537	3,749	3,872	3,773	3,877	4,255	4,042	3,737	3,726	3,404	3,241	.....
Hours.....		16	12				10	8					.....
Cubic yards.....		4,018	3,508				4,118	3,399					.....
Average hourly output—													
Working time..	227.3	248.3	300	329	342.1	333	396.4	435.4	462.3	421.3	397.6	466.8	348.5
Total time.....	157.5	173.4	196	260	157.5	257	294.9	334.3	403.3	358.1	281.2	291.8	253.8
Monthly output.....	62,996	74,925	69,733	78,080	66,699	80,244	84,072	72,242	87,109	68,746	58,483	60,704	864,023
Operating cost per cubic yard, dolls..	1.2542	1.1474	1.1023	0.9202	0.9810	0.8361	0.7368	0.7173	0.6784	0.6686	0.8246	0.7549	0.8786
Plant arbitrary, do..	0.5152	0.5152	0.5152	0.5151	0.5152	0.5152	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5076
Total cost..... do.	1.7694	1.6626	1.6175	1.4353	1.4962	1.3513	1.2368	1.2173	1.1784	1.1686	1.3246	1.2549	1.3862

Cubic yards,

Maximum monthly output, March, 1911.....	87,109
Maximum daily output, 24 hours, Aug. 25, 1910.....	4,537
Maximum daily output, 16 hours, Aug. 24, 1910.....	4,018
Maximum daily output, 12 hours, Jan. 4, 1911.....	4,255
Maximum daily output, 10 hours, Jan. 24, 1911.....	4,118
Maximum daily output, 8 hours, Mar. 15, 1911.....	3,737
Maximum hourly output for one month, June, 1911.....	466.8
Maximum hourly output for one month, March, 1911.....	403.3

<sup>1</sup> Per hour of working time.

<sup>2</sup> Per hour of total time.

*Comparative statement—Porto Bello quarry.*

	July.	August.	Sept.	Oct.	Nov.	Dec.
<b>Quarrying:</b>						
Stripping.....	\$0.0280	\$0.0353	\$0.0242	\$0.0172	\$0.0183	\$0.0126
Dumps for stripping.....	.0067	.0002	.0022	.0025	.0035	.0007
Drilling.....	.0714	.0668	.0654	.0475	.0555	.0379
Blasting.....	.3652	.2915	.2262	.2109	.1952	.1625
Loading.....	.1344	.1221	.1218	.0855	.0958	.0799
Transportation.....	.1031	.0675	.0686	.0778	.0946	.0706
Tracks.....	.0562	.0423	.0311	.0399	.0468	.0619
Power.....	.0386	.0382	.0393	.0364	.0308	.0234
Maintenance of equipment.....	.1258	.1399	.1088	.1058	.0952	.1314
Plant arbitrary.....	.3401	.3401	.3401	.3400	.3401	.3401
Total.....	1.2665	1.1539	1.0877	.9635	.9758	.9210
<b>Crushing:</b>						
Operation of crushers.....	.0490	.0469	.0462	.0424	.0557	.0339
Stone bins and conveyors.....	.0375	.0308	.0423	.0372	.0468	.0263
Power.....	.0361	.0404	.0416	.0385	.0325	.0250
Maintenance of equipment.....	.0918	.1010	.1253	.1017	.1594	.1340
Plant arbitrary.....	.1751	.1751	.1751	.1751	.1751	.1751
Total.....	.3895	.3942	.4305	.3949	.4695	.3943
<b>Water transportation:</b>						
Operation of tugs and barges.....	.1437	.1276	.1214	.1285	.1785	.1918
Maintenance of equipment.....	.0358	.0476	.0455	.0326	.1106	.1042
Plant arbitrary.....	.2240	.2240	.2239	.2240	.2240	.2240
Total.....	.4035	.3992	.3908	.3851	.5131	.5200
<b>Unloading barges and transporting to rock pile, Gatun:</b>						
Plant arbitrary.....	.3195	.2704	.2153	.3565	.2811	.2951
Plant arbitrary.....	.2030	.2030	.2029	.2029	.2030	.2030
Total.....	.5225	.4734	.4182	.5594	.4841	.4981
<b>Division expense.....</b>	.1134	.1145	.0993	.0769	.0500	.0360
<b>Grand total cost.....</b>	2.6954	2.5352	2.4265	2.3798	2.4934	2.3694
<b>Output..... cubic yards..</b>	62,996	74,925	69,733	78,080	66,699	80,244

*Comparative statement—Porto Bello quarry—Continued.*

	Jan.	Feb.	Mar.	Apr.	May.	June.
<b>Quarrying:</b>						
Stripping.....	\$0.0018	\$0.0041	\$0.0026	\$0.0236	\$0.0089	\$0.0010
Dumps for stripping.....	.0018	.0037	.0046	.0023	.0084	.0019
Drilling.....	.0381	.0405	.0315	.0375	.0376	.0355
Blasting.....	.1690	.1499	.1437	.1373	.1810	.1701
Loading.....	.0867	.0845	.0683	.0728	.0812	.0803
Transportation.....	.0682	.0720	.0572	.0613	.0693	.0666
Tracks.....	.0382	.0383	.0272	.0220	.0727	.0400
Power.....	.0360	.0190	.0191	.0197	.0244	.0223
Maintenance of equipment.....	.0735	.0861	.0540	.0542	.0945	.1189
Plant arbitrary.....	.3300	.3300	.3300	.3300	.3300	.3300
<b>Total.....</b>	<b>.8433</b>	<b>.8281</b>	<b>.7382</b>	<b>.7607</b>	<b>.9080</b>	<b>.8666</b>
<b>Crushing:</b>						
Operation of crushers.....	.0222	.0259	.0224	.0246	.0360	.0266
Stone bins and conveyors.....	.0274	.0244	.0384	.0219	.0209	.0165
Power.....	.0389	.0417	.0410	.0421	.0522	.0476
Maintenance of equipment.....	.1038	.1032	.1397	.1212	.1068	.0939
Plant arbitrary.....	.1700	.1700	.1700	.1700	.1700	.1700
<b>Total.....</b>	<b>.3623</b>	<b>.3652</b>	<b>.4115</b>	<b>.3798</b>	<b>.3859</b>	<b>.3546</b>
<b>Water transportation:</b>						
Operation of tugs and barges.....	.1920	.1553	.1572	.1833	.1675	.1594
Maintenance of equipment.....	.2218	.1376	.0881	.1345	.1713	.1490
Plant arbitrary.....	.1710	.1710	.1710	.1710	.1710	.1710
<b>Total.....</b>	<b>.5848</b>	<b>.4639</b>	<b>.4163</b>	<b>.4888</b>	<b>.5098</b>	<b>.4794</b>
<b>Unloading barges and transporting to rock pile, Gatun.....</b>	<b>.3407</b>	<b>.3089</b>	<b>.1776</b>	<b>.2504</b>	<b>.3185</b>	<b>.3183</b>
<b>Plant arbitrary.....</b>	<b>.2070</b>	<b>.2070</b>	<b>.2070</b>	<b>.2070</b>	<b>.2070</b>	<b>.2070</b>
<b>Total.....</b>	<b>.5477</b>	<b>.5159</b>	<b>.3846</b>	<b>.4574</b>	<b>.5255</b>	<b>.5253</b>
<b>Division expense.....</b>	<b>.0312</b>	<b>.0240</b>	<b>.0287</b>	<b>.0281</b>	<b>.0308</b>	<b>.0337</b>
<b>Grand total cost.....</b>	<b>2.3693</b>	<b>2.1971</b>	<b>1.9793</b>	<b>2.1148</b>	<b>2.3600</b>	<b>2.2596</b>
<b>Output.....cubic yards.</b>	<b>84,072</b>	<b>72,242</b>	<b>87,109</b>	<b>68,746</b>	<b>58,483</b>	<b>80,704</b>

On September 19 the working hours were changed from 16 to 12 per day, on January 16 from 12 to 10, on February 15 from 10 to 8, and on June 19 the output of crushed stone was reduced to three barges (approximately 1,800 cubic yards) per day.

On June 28, 1910, there were 139 gold and 757 silver employees on the rolls, a total of 896; on June 27, 1911, 70 gold, 363 silver, a total of 433.

The necessary plant has been ordered for the production of large stone for the armor of the Colon Breakwater, and the wharf for loading this stone at Porto Bello is 95 per cent completed.

## PROCURING SAND AT NOMBRE DE DIOS.

During the year the following amounts of sand were excavated and shipped to Gatun:

	Cubic yards.
By cranes.....	32,651
By dredge No. 3.....	1,650
By dredge Nombre.....	25,513
By dredge No. 4.....	382,105
<b>Total.....</b>	<b>441,919</b>

In addition 105,851 cubic yards of material were removed from the channel, of which 26,138 cubic yards were pumped into the dam,

18,788 cubic yards used for fill in the village, and 60,925 cubic yards deposited in the sea.

The 73 buildings destroyed by fire on April 8, 1910, were replaced by new buildings in the rear of the town and the sand in the burned area excavated.

The 18-inch pipe-line dredge *No. 4* arrived at Nombre de Dios on August 26, 1910, and has since been engaged in excavating sand. During the latter part of May her cut was extended through to the beach on the west side of the village. The heavy seas in June entirely filled this part of her cut, depositing about 125,000 cubic yards of sand.

The cranes and rolling stock which had been in use during the first part of the year were removed in May.

The operating cost of procuring sand at Nombre de Dios is shown by months in the following table:

*Comparative statement—Nombre de Dios.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
<b>Dry excavation:</b>						
Loading by crane.....	\$0. 5438	\$0. 4396	\$0. 4488	\$52. 2407		
Maintenance of equipment.....	. 1393	. 2070	. 1286	11. 4315		
<b>Dredging excavation:</b>						
Clearing.....						\$0. 0065
Operation dredge—						
Nombre.....	. 1792	. 1826	. 0800	. 0616	\$0. 0646	. 0182
No. 3, etc.....	. 1535	. 1426	. 0085	. 0156	. 0200	. 0078
No. 4.....	. 0000	. 1461	. 2392	. 1461	. 1627	. 1615
Maintenance of equipment.....	. 2776	. 4744	. 2597	. 2316	. 0629	. 0894
Total operating cost.....	. 6418	. 8122	. 5857	. 5058	. 3129	. 2834
Plant arbitrary.....	. 4670	. 4680	. 4680	. 4680	. 4080	. 4680
Total local cost.....	1. 1088	1. 2802	1. 0537	. 9738	. 7809	. 7514
<b>Water transportation:</b>						
Operation of tugs and barges.....	. 2673	. 2481	. 1817	. 1923	. 1708	. 2356
Maintenance of equipment.....	. 0802	. 0849	. 0867	. 0435	. 0424	. 0984
Plant arbitrary.....	. 2310	. 2309	. 2310	. 2310	. 2310	. 2310
Total.....	. 5785	. 5639	. 4994	. 4668	. 4442	. 5050
<b>Unloading barges and transporting sand to pile at Gatun.....</b>	. 2562	. 2938	. 2273	. 2823	. 2777	. 3227
<b>Plant arbitrary.....</b>	. 1370	. 1370	. 1370	. 1370	. 1370	. 1370
Total.....	. 3932	. 4308	. 3643	. 4193	. 4147	. 4597
<b>Division expense.....</b>	. 0846	. 1232	. 0670	. 0475	. 0161	. 0116
Grand total.....	2. 1651	2. 3981	1. 9844	1. 9074	1. 6559	1. 7877
<b>Output:</b>						
Crane..... cubic yards..	10, 818	12, 955	5, 730	36		
Dredge..... do.....	14, 208	16, 067	27, 652	44, 655	45, 375	42, 092
Total..... do.....	25, 026	29, 022	33, 382	44, 691	45, 375	42, 092
	Jan.	Feb.	Mar.	Apr.	May.	June.
<b>Dry excavation:</b>						
Loading by crane.....						
Maintenance of equipment.....						
<b>Dredging excavation:</b>						
Clearing.....	\$0. 0166	\$0. 0155	\$0. 0034	\$0. 0019	\$0. 0021	\$0. 0160
Operation dredge—						
Nombre.....	. 0134	. 0041	. 0011	. 0007	. 0010	. 0013
No. 3, etc.....	. 0066	. 0332	. 0133	. 0049	. 0092	. 0092
No. 4.....	. 2454	. 2159	. 1770	. 1473	. 2065	. 2792
Maintenance of equipment.....	. 0545	. 0235	. 0278	. 0129	. 0085	. 0638
Total operating cost.....	. 3428	. 3414	. 2383	. 1677	. 2145	. 3595
Plant arbitrary.....	. 4800	. 4800	. 4800	. 4800	. 4800	. 4800
Total local cost.....	. 8228	. 8214	. 7183	. 6477	. 6945	. 8395

*Comparative statement—Nombre de Días—Continued.*

	Jan.	Feb.	Mar.	Apr.	May.	June.
<b>Water transportation:</b>						
Operation of tugs and barges.....	\$0. 2439	\$0. 2540	\$0. 1747	\$0. 1875	\$0. 1806	\$0. 2380
Maintenance of equipment.....	. 1986	. 1561	. 1146	. 1407	. 1809	. 1707
Plant arbitrary.....	. 2110	. 2110	. 2110	. 2110	. 2110	. 2110
<b>Total.....</b>	<b>. 6535</b>	<b>. 6211</b>	<b>. 5003</b>	<b>. 5392</b>	<b>. 5725</b>	<b>. 6197</b>
<b>Unloading barges and transporting sand to pile at Gatun.....</b>	<b>. 3155</b>	<b>. 3559</b>	<b>. 1953</b>	<b>. 2618</b>	<b>. 3277</b>	<b>. 3558</b>
Plant arbitrary.....	. 1620	. 1620	. 1620	. 1620	. 1620	. 1620
<b>Total.....</b>	<b>. 4775</b>	<b>. 5179</b>	<b>. 3573</b>	<b>. 4238</b>	<b>. 4897</b>	<b>. 5178</b>
Division expense.....	. 0145	. 0103	. 0068	. 0061	. 0065	. 0125
<b>Grand total.....</b>	<b>1. 0683</b>	<b>1. 9707</b>	<b>1. 5827</b>	<b>1. 6168</b>	<b>1. 7632</b>	<b>1. 9895</b>
<b>Output:</b>						
Crane..... cubic yards.....						
Dredge..... do.....	28, 994	33, 412	47, 885	47, 801	40, 003	24, 236
<b>Total..... do.....</b>	<b>28, 994</b>	<b>33, 412</b>	<b>47, 885</b>	<b>47, 801</b>	<b>40, 003</b>	<b>24, 236</b>

**WATER TRANSPORTATION.**

In connection with this service the plant steamed about 125,000 miles, handled about 9,315 barges, and carried about 31,350 passengers. Two mud scows which had been converted into stone barges were returned to the dredging service. During the storm on December 3 barge *No. 7*, loaded with crushed rock, broke away from the tow and drifted ashore on Colon beach. When the sea subsided the barge was pulled off the beach into deep water, and after slight repairs was put back into service.

**COLON BREAKWATERS.**

[See Plate 98.]

Early in the year all buildings were finished; machines installed in the repair shop; a large amount of piling and trestle material stored. In connection with the construction of the reservoir for water supply, dams containing 54,390 cubic yards of fill were constructed, necessary pipe line laid, and other preliminary work was done.

Trestle work started August 9, 1910.

One 70-ton Bucyrus shovel commenced work early in September, and a second one about October 1.

At the end of the year 5,365 lineal feet of double-track trestle had been built, and 359,890 cubic yards of fill dumped from the trestle; 45,918 cubic yards of material were used for ballast; 216,172 lineal feet of drilling was done; 654,146 pounds of dynamite used; 1,000,235 cubic yards of material blasted; 34,797 lineal feet of new track laid.

The amount of rock dredged from the prism and dumped in the vicinity of the West Breakwater was 619,152 cubic yards.

*Comparative statement—Colon breakwater, 1910-1911.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
<b>Excavation:</b>						
Surveys.....			\$0. 1091	\$0. 0282	\$0. 0270	\$0. 0177
Clearing.....			.1936	.0352	.0563	.0424
Drilling.....			.3666	.0546	.0631	.0600
Blasting.....			.7979	.0246	.2493	.2027
Loading by power.....			.2256	.0654	.1027	.1076
Tracks.....			.9391	<b>1.889</b>	.1482	.1111
Transportation.....			.1825	.0772	.1170	.0986
Maintenance of equipment.....			.3476	.0278	.0447	.0024
<b>Total.....</b>			3. 1620	. 1441	.8083	. 6425
<b>Filling:</b>						
Trestles.....			2. 2692	1. 0711	. 2101	. 3166
Dumping.....			.1024	.0491	.0363	.0268
Maintenance of equipment.....			<b>.0094</b>	.0000	.0074	.0185
<b>Total.....</b>			2. 3622	1. 1202	. 2538	. 3619
Plant arbitrary.....			.1100	.1100	.1100	.1100
Division expense.....			.5631	.1171	.0534	.0399
Tug service.....			.5047	.0717	.0394	.0504
<b>Grand total.....</b>			6. 7020	1. 5631	1. 2649	1. 2047
Cubic yards.....			6, 862	30, 762	29, 904	38, 998

	Jan.	Feb.	Mar.	Apr.	May.	June.
<b>Excavation:</b>						
Surveys.....	\$0. 0057	\$0. 0386	\$0. 0135	\$0. 0254	\$0. 0192	\$0. 0036
Clearing.....	.0359	.0429	.0090	<b>.0045</b>	.0000	.0024
Drilling.....	.0664	.0633	.0470	.0545	.0655	.0310
Blasting.....	.1262	.1881	.3173	.2761	.2803	.2028
Loading by power.....	.0985	.1440	.0844	.1191	.0509	.0652
Tracks.....	.0318	.0556	.0788	.4132	.0203	.0785
Transportation.....	.0675	.1147	.0864	.1135	.1174	.1039
Maintenance of equipment.....	.0146	.0707	.1531	.0330	.0900	.0658
<b>Total.....</b>	. 4366	. 7079	. 7895	1. 0303	. 6496	. 5532
<b>Filling:</b>						
Trestles.....	1. 2586	. 5661	. 2991	. 1661	<b>2. 0907</b>	. 2441
Dumping.....	.0173	.0224	.0207	.0215	.0272	.0116
Maintenance of equipment.....	.0263	.1357	<b>.0925</b>	.0171	.0165	.0148
<b>Total.....</b>	1. 3022	. 7242	. 2273	. 2047	<b>2. 0470</b>	. 2705
Plant arbitrary.....	.1690	.1690	.1690	.1690	.1690	.1690
Division expense.....	.0316	.0359	.0361	.0378	.0384	.0347
Tug service.....	.0658	.0484	.0480	.0691	.0643	.0309
<b>Grand total.....</b>	2. 0052	1. 6854	1. 2699	1. 5109	<b>1. 1257</b>	1. 0583
Cubic yards.....	46, 849	35, 135	45, 483	40, 699	38, 534	46, 664

The above are division costs. Figures in heavy-face type are credits.

**GATUN LOCKS.**

[Maj. James P. Jervoy, resident engineer, in local charge.]

**EXCAVATION.**

[See Plate 99.]

At the beginning of the fiscal year 1910-11 the shovel excavation in the forebay, upper lock, and middle lock was completed.

The trench excavation was completed in the upper lock, and 45 per cent completed in the middle lock.

During the fiscal year 1910-11 the trench excavation in the middle lock, and the shovel and crane excavation in the lower lock were completed.

The trench excavation in the lower lock was 99 per cent completed.

The amount and cost of excavation in the lower lock were increased by slides on both the east and west sides.

Between July 1, 1910, and June 30, 1911, a total of 475,875 cubic yards were removed by shovel, at a division cost of \$0.7110 per cubic yard; 152,582 cubic yards were removed by shovel, crane, and hand, in preparing foundations, at a division cost of \$1.5540 per cubic yard.

The total amount removed in the lock chambers up to June 30, 1911, by steam shovel, amounts to 4,555,395 cubic yards, at a cost of \$0.6048 per cubic yard.

The total amount removed to June 30, 1911, in preparing foundations, is 186,425 cubic yards, at a cost of \$1.7284 per cubic yard.

The excavation remaining north of the north caisson sill will be removed by suction and dipper dredge after the completion of the cofferdam now being erected on the north caisson sill.

#### CONCRETE MATERIAL.

During the year a total of 795,215 cubic yards of stone and 424,555 cubic yards of sand have been unloaded and stored; 945,525 barrels of cement have been received.

The delivery of cement in bags, instead of barrels, was started in May, 1911, as experience in the Pacific division indicated more economical results with bags than with barrels. The rate of placing concrete has made the time of storage short.

#### UNLOADING PLANT.

All material received was unloaded by cableways, derricks, and electric cranes.

The Mindi derricks were removed, about January 1, to a point west of the cement shed, and have been worked two shifts per day unloading sand.

The cableways have been operated for three shifts per day throughout the year.

On July 1 the working hours of the cableways and the sand derricks were reduced to one shift, and the working hours for the rock derricks to two shifts.

The cableways have unloaded a total of 500,550 cubic yards of rock and 241,858 cubic yards of sand during the year, at the rate of 42.77 cubic yards per hour, actual working time, and the derricks 294,665 cubic yards of rock and 166,606 cubic yards of sand, at the rate of 40.91 cubic yards per hour, actual working time.

An additional derrick and rock screen were completed in February, and 2,003 cubic yards of screened rock for reenforced concrete work and concrete piles have been produced at a total division cost of \$2.9059 per cubic yard, including unloading and screening.

#### HANDLING AND MIXING PLANTS.

The automatic railway has been changed from a third-rail system to a trolley system, and is operating satisfactorily. It has handled over a million tons of material during the year.

The two mixing plants have been kept in satisfactory operation, and a total of 601,777 cubic yards have been mixed by plant No. 1 and 225,577 cubic yards by plant No. 2. A total of 10,175 cubic yards has been mixed by portable mixers and by hand.

## CONCRETE WORK.

[See Plate 101.]

At the beginning of the year 513,802½ cubic yards of concrete had been placed. During the fiscal year a total of 902,926 cubic yards of plain concrete and 8,211 cubic yards of reenforced concrete have been placed, making the total for the year 911,137 cubic yards, and the total to date 1,424,940 cubic yards. Included in the total number of cubic yards of concrete placed is 73,608 cubic yards of large rock.

On a basis of 2,085,000 cubic yards, the masonry work for the entire system of locks at the close of the year was 68.34 per cent completed.

In general, the massive work in the upper and middle locks is completed. The foundations for both side walls in the lower lock as far north as the caisson sill are completed, and the floor in the lower lock is 75 per cent completed.

The side walls in the lower lock are 50 per cent completed, and work has been commenced in the middle wall.

The average division cost for the year for taking concrete material from storage, mixing, and placing in the lock walls has been as follows:

*Cost per cubic yard.*

Forms .....	\$0. 4869
Mixing .....	. 1756
Placing and finishing .....	. 3285
Reenforcements .....	. 0241
Pumps .....	. 0417
Power .....	. 0666
Maintenance of equipment .....	. 2357
Division expense .....	. 0914
Plant arbitrary .....	. 6969
<b>Total .....</b>	<b>2. 1474</b>

(Mixing includes a haul of 2,000 feet and a lift of 63 feet for 66.6 per cent of the total amount of concrete placed.)

Attached is a comparative statement of concrete costs for the year:

*Comparative statement of costs—Gatun locks construction.*

Masonry.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Concrete.....cubic yards..	77,470	77,635	69,039	78,535	68,534	73,100
Cement.....	\$1. 8961	\$1. 8947	\$1. 8359	\$1. 8735	\$1. 8471	\$1. 8074
Stone.....	2. 3620	2. 3486	2. 2559	2. 2074	2. 1166	2. 0771
Sand.....	. 7269	1. 0152	1. 0091	1. 0236	. 7752	. 7919
Mixing.....	. 1325	. 1937	. 2162	. 1859	. 2135	. 1643
<b>Total cost.....</b>	<b>5. 1175</b>	<b>5. 4522</b>	<b>5. 3171</b>	<b>5. 2904</b>	<b>4. 9524</b>	<b>4. 8407</b>
Large rock.....cubic yards..	6,531	8,051	7,681	8,414	6,618	6,840
<b>Cost.....</b>	<b>\$1. 4424</b>	<b>\$1. 3815</b>	<b>\$1. 2412</b>	<b>\$1. 0004</b>	<b>\$1. 1499</b>	<b>\$1. 4649</b>



*Comparative statement of costs—Gatun locks construction—Continued.*

Masonry.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Masonry.....cubic yards..	84,001	85,686	76,720	86,949	75,152	79,940
Concrete.....	\$4.7196	\$4.9389	\$4.7847	\$4.7785	\$4.5163	\$4.4264
Large rock.....	.1121	.1298	.1243	.0969	.1012	.1253
Wood forms.....	.2975	.4154	.4204	.3540	.3021	.4132
Steel forms.....	.0906	.0915	.1114	.1047	.0811	.0938
Placing.....	.3155	.2526	.2813	.3888	.4522	.3315
Reinforcements.....	.0209	.0284	.0374	.0535	.0090	.0264
Pumps.....	.0262	.0483	.0278	.0057	.0504	.0350
Power.....	.0517	.0633	.0645	.0700	.0855	.0690
Maintenance of equipment.....	.1312	.1847	.2895	.2558	.2890	.2422
Plant arbitrary.....	.6850	.6850	.6850	.6850	.6850	.6850
Division expense.....	.1011	.1145	.1243	.1250	.1104	.0784
Total division cost.....	6.5514	6.9534	6.9506	6.9179	6.6822	6.5262

Masonry.	Jan.	Feb.	Mar.	Apr.	May.	June.
Concrete.....cubic yards..	67,257	60,014	79,801	62,021	60,818	49,293
Cement.....	\$1.8413	\$1.7225	\$1.7265	\$1.7406	\$1.4229	\$1.5919
Stone.....	2.0301	1.9779	1.8867	1.8513	1.9407	1.9641
Sand.....	.8421	.9083	.8126	.8087	.7019	.8946
Mixing.....	.1008	.1574	.1432	.1783	.1904	.1814
Total cost.....	4.8743	4.7661	4.5690	4.5849	4.2559	4.6320
Large rock.....cubic yards..	4,972	5,051	5,098	3,735	5,407	4,611
Cost.....	\$1.2372	\$1.0684	\$1.3516	\$1.5588	\$2.3514	\$0.9705
Masonry.....cubic yards..	72,229	71,065	85,299	65,756	66,225	53,904
Concrete.....	\$4.5388	\$4.4274	\$4.2638	\$4.3245	\$3.9085	\$4.2357
Large rock.....	.0852	.0759	.0903	.0886	.1920	.0831
Wood forms.....	.4694	.3611	.3218	.4006	.4242	.4182
Steel forms.....	.1070	.0709	.1077	.1637	.1167	.1701
Placing.....	.3317	.3297	.2720	.3241	.3204	.3608
Reinforcements.....	.0301	.0098	.0030	.0068	.0452	.0126
Pumps.....	.0290	.0292	.0353	.0373	.1129	.0925
Power.....	.0750	.0690	.0539	.0661	.0826	.0497
Maintenance of equipment.....	.2667	.2227	.2349	.2116	.1912	.3474
Plant arbitrary.....	.7110	.7110	.7110	.7110	.7110	.7110
Division expense.....	.0822	.0571	.0563	.0736	.0701	.0918
Total division cost.....	6.7261	6.3638	6.1500	6.4079	6.1748	6.5729

## POWER PLANT.

The power plant has been operated satisfactorily during the year, the total production of electrical energy being 12,962,247 kilowatt hours, at an average division cost of \$0.0227 per kilowatt hour.

The monthly load on the plant now amounts to over 1,500,000 kilowatt hours.

The energy has been produced during the year with an expenditure of 0.0072 barrel of oil per kilowatt hour.

The only changes in the plant during the year have been the installation of a second air compressor, and the addition of reactances to the main generators to prevent damage from short circuits.

Considerable trouble was experienced in the early part of the year due to the fact that the circulating water was so impregnated with salt that serious erosion of the heads and tubes in the base condensers was evident. This unsatisfactory condition of affairs has been modified by driving a sheet pile dam across the east diversion which impounds the fresh water from natural drainage sources north of the power plant.

## CONCRETE PILES.

In November and December, 1910, several types of concrete piles were made and tested. As a result of these experiments a type of reinforcement, consisting of angles at the corners of the piles, connected at 18-inch intervals by iron straps, was adopted. This type of reinforcement was ordered in 15-foot sections, which could be readily connected by splice bars. These sections were shipped from the United States, riveted up, and piles varying in length from 15 feet up to any multiple of 15 feet desired can readily be constructed.

Before the arrival of the reinforcement from the States, all available round material on the isthmus was fabricated at the Gorgona shops into a type of pile using rod reinforcement connected by steel couplings.

A total of 31,060 feet of this improvised piling has been constructed and 8,196 feet driven.

Some trouble has been experienced with piles recently made, due, apparently, either to slow setting or imperfectly setting concrete. It is thought, however, that this difficulty will be overcome and that the pile adopted will be satisfactory.

## TESTS OF STONEY GATE VALVES.

A temporary concrete platform for testing Stoney gate valves was built in the west chamber of the upper lock. The valve was placed in a horizontal position on this testing platform and was loaded with pig iron until the total weight was equivalent to the head of water under which the gate will operate.

The gate was then pulled back and forth under varying conditions, with a view to determining the force necessary to start the gate and to keep it in motion.

It was also kept in motion for a number of days in succession, with a view to determining possible wear on the roller path.

These tests were satisfactory and indicated that the pull required to start the gate was 0.0192 per cent of the load and the pull required to keep it in motion 0.0143 per cent of the load.

With a view of determining its action under service conditions, a Stoney gate valve was installed in the west side wall culvert, upper lock, and arrangements made to create against it a head equal to the full lake head. Tests were commenced early in July.

## DISCHARGE TESTS.

Under orders from the chairman's office, the filling was removed from the experimental dam and the supporting timber work converted into a tank for making experiments on the discharge of water from various outlets. The details of these experiments were conducted directly by the chairman's office.

## GATE ERECTION.

Actual gate erection was commenced in May, 1911. This division has not been directly concerned with the gate erection, but has prepared the necessary back fill, storage tracks, and erection tracks for the contractor. Such assistance has also been rendered to the inspectors from the chairman's office as they have from time to time called for.

## FIXED STEEL WORK.

The erection of fixed steel during the year has included the placing of reaction castings, material in Stoney gate valves, material in gate sills, snubbing hooks, anchorage bolts, etc.

A total of 3,904.79 tons of fixed steel has been placed during the year, at an average cost of \$23.53 per ton for handling and placing.

## TEMPERATURE CHARTS.

The reading of temperatures indicated by thermometers set at several points in the wall monoliths has been continued. Apparently the concrete has reached approximately its normal temperature. A chart is hereto attached showing the readings for the year. (See Pl. 100.)

## SLIDES.

Considerable trouble has been caused by slides in the lower lock, especially on the east side. It was necessary to excavate to a depth of 66 feet below sea level at the north end of the east side wall before rock suitable for foundation purposes was encountered.

At the close of the year a toe wall had been constructed on the east side of the lock, throughout its entire length. The slide on the west side has become stationary. It is not therefore believed that there will be any more trouble from slides at any point south of the north caisson sill. The experience to date, however, indicates that slides are probable in excavating for the north approach and flare walls.

## BACK FILL.

The back filling in the rear of the side walls of all locks has been partially placed during the year, and back fill in the center wall of the upper lock commenced.

A total of 542,576 cubic yards, at an average division cost of \$0.5380 per cubic yard, had been placed to June 30, 1911.

Trestles for continuing the back fill in the rear of the walls of the lower lock have been driven on both sides of that lock. These trestles will also carry the extension of the cableway tracks, and the cost of their erection has been equally divided between the plant charge against the lock cableways and back fill.

## ESTIMATES OF WORK ACCOMPLISHED.

[See Plate 101.]

The following table indicates the quantities of work for which congressional appropriations were made and the work actually accomplished.

	Estimated.	Actually accomplished.
Concrete.....	<i>Cubic yards.</i> 750,000	<i>Cubic yards.</i> 911,137
Back fill.....	200,000	538,386

Subsequent to the date of the congressional appropriation, the progress of the work was such as to indicate that the above esti-

mated amounts would be exceeded, and an allotment was therefore requested covering the placing of 960,000 cubic yards of concrete and 400,000 cubic yards of back fill.

### GATUN DAM AND SPILLWAY.

[Maj. George M. Hoffman, resident engineer, in local charge.]

#### GATUN DAM.

[See Plate 102.]

At the beginning of the fiscal year construction work had been extended to the full length of the dam. Thereafter the dumps of dry fill constituting the north and south toes were advanced as rapidly as practicable, being carried inward toward the axis and raised so as to follow generally the approved slopes; and the dredges available continued pumping impervious fill between the toes, their discharge being transferred as required between the sections east and west of the spillway.

Only one interruption of any consequence was experienced—that occasioned by the flood of December, which covered the double track south of Gatun and cut off the supply of material from the central division for one week. Drift brought down by the flood accumulated at the main-track trestle crossing above the spillway, and several bents were damaged so as to require redriving; this and a general strengthening of the structure was accomplished before heavy traffic was resumed, and in the interval the steel bridge and track connections, constructed in anticipation of this contingency, gave satisfactory approaches to all parts of the dam.

A new high trestle at elevation plus 45 was built across the head of the spillway in January to give easier access to the constantly rising dumps of the west section and to replace the old trestle, which was beginning to show signs of weakness. The old trestle was removed except for stubs at either bank, which were retained to assist in protecting the new trestle from drift, and in removing accumulations of same. The old trestle at the north end of the spillway was continued in service until November, and was afterwards removed, north toe traffic being diverted to the more satisfactory route over the steel bridge.

With the advance of the dry fill to higher levels; with the increase in the number of long trains from the central division, which began early in the year; and with the utilization of central division material on all parts of the dam as that from other sources diminished, extensive additions were made necessary to the track system in yards, switchbacks, passing tracks, and connecting tracks. Improvements to track facilities were made as required throughout the year, and a high state of efficiency maintained on the running tracks in order that the heavy trains of twenty-seven 20-yard dump cars and thirty-five 12-yard dump cars might be handled safely and expeditiously to the dumps at the high rate of speed required to overcome the heavy grades. A pusher engine is now generally used and dumps 90 feet above sea level are readily reached with full trains; only for the top of the dam and for placing a moderate amount of material will the slow method of cutting trains have to be resorted to. Tracks connected with the construction of the dam and auxiliary works have a total length of 21 miles.

Dry fill, placed in the toes of the dam, was received from the various sources stated in the following table, quantities being determined by car measurement, 17 cubic yards for large cars, and 10 cubic yards for small cars:

	Cubic yards.
Central division.....	2, 065, 272
Locks.....	320, 599
Mindi.....	8, 179
Spillway and borrow pit.....	332, 044
Total.....	2, 726, 094

The total net dry fill in place above the original surface, as determined by cross-section survey of June, 1911, amounts to 6,881,042 cubic yards, an increase during the fiscal year of 2,060,186 cubic yards, net. Up to a year ago, dry fill in place was rated as having an increase over car measurement of 25 per cent. This was practically correct as long as the material was deposited on the original or other solid foundation; but in working out into the hydraulic fill, much of the dry fill sank into the softer parts where it is impracticable to include it in cross sections of dry fill in place. On this account, a reduction of 596,600 cubic yards reported in place was made to agree with the September, 1910, survey; and a further reduction of 69,309 cubic yards was made to agree with the June, 1911, survey. Comparison between the car yardage delivered and the net yardage in place shows a loss of 665,908 cubic yards during the fiscal year. After the survey of September, 1910, the first complete survey which it was practicable to make, cross sections were made each month of material placed during the month with a view of reporting only net yardage; partial success only has been attained, as there is a subsequent loss due to slides of dry fill into wet fill, and to a gradual subsidence of the former under the action of heavy trains passing and dumping. In addition, there is a loss from slow general consolidation which can only be checked by complete surveys. It is contemplated to make such surveys twice a year.

Dredges pumping into the east section of the dam were assisted by relay pumps throughout the year; in the west section relay No. 5 was put in service on January 8, and relay No. 4 on January 30, and thereafter all dredges were connected to relays. Both the dredges and relay pumps have given excellent service, the outputs by months, borrow-pit measurement, being as follows:

Months.	Dredges.					Total.
	No. 82.	No. 83.	No. 85.	No. 86.	Sandpiper.	
1910.	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
July.....	75, 473	138, 323	166, 958	216, 969	.....	597, 623
August.....	11, 725	113, 211	158, 506	253, 824	.....	537, 266
September.....	122, 045	65, 565	141, 378	243, 058	.....	572, 046
October.....	98, 776	111, 734	118, 096	255, 308	.....	583, 914
November.....	119, 464	94, 506	.....	.....	.....	213, 970
December.....	165, 503	141, 112	108, 418	.....	.....	410, 033
1911.						
January.....	89, 199	29, 069	185, 909	.....	.....	304, 177
February.....	130, 850	136, 144	136, 752	.....	.....	403, 746
March.....	152, 900	155, 850	175, 850	.....	.....	484, 600
April.....	170, 000	111, 600	122, 350	.....	48, 260	452, 210
May.....	134, 000	147, 820	138, 600	.....	127, 500	547, 920
June.....	140, 300	211, 791	159, 900	.....	112, 400	624, 391
Total.....	1, 410, 235	1, 456, 725	1, 607, 717	969, 069	288, 160	5, 731, 896

Total wet fill in place, calculated from cross sections, amounts to 7,411,992 cubic yards, an increase during the fiscal year of 3,758,870 cubic yards. From the borrow-pit measurement there is therefore a loss of 1,973,026 cubic yards (34 per cent), of which 441,782 cubic yards was slow general consolidation of the whole embankment as shown by comparison of surveys of September, 1910, and June, 1911. The balance of 1,531,243 cubic yards is chargeable to other causes, such as wasting soft material through drainage pipes; filling voids of dry fill; leakage, and compacting of fill, under action of waters and pressure, into smaller compass than obtains at borrow pits. As with the dry fill, an effort has been made by monthly cross sections to ascertain the net amount actually in place after each month's work; but the amounts thus determined will be, as heretofore, subject to corrections that can be computed only from complete surveys of the whole dam.

The total net yardage, both wet and dry, in place amounts to 14,293,034 cubic yards, an increase during the fiscal year of 5,819,056 cubic yards. To complete the dam above present levels will require 5,089,156 cubic yards, net; and an additional amount of 707,223 cubic yards, net, must be handled—generally from near-by extra material deposited for the purpose—if all low portions of the dam, caused by consolidation, track inclines, etc., are raised to full grade and section. Comparison of the net yardage placed with that required shows the dam to be 74 per cent completed.

Plate 102 shows sections of the dam east and west of the spillway with progress made during the year indicated thereon. In general terms, the north and south toes, east section, have advanced from an average elevation of +65 to +85 and the hydraulic fill between from +51 to +73; the north and south toes, west section, have advanced from average elevations of +30 and +35 to +60 and +67, respectively, and the hydraulic fill between from +16 to +51.3.

At the end of December a borrow pit was opened north of the dam to furnish special impervious clay and other additional dry fill. To the end of the year the total excavated by steam shovels amounted to 156,726 cubic yards.

Miscellaneous work connected with the construction of the dam included installation of necessary pipe drainage systems from the hydraulic fill; construction of trestles for tracks and dredge pipe lines; clearing ahead of dredges; stripping and spading up subsoil in advance of hydraulic fill; laying extensive shore pipe systems from dredges and relays to points of discharge all along the toes.

For two periods—September 16 to November 11 and January 1 to April 15—hydraulic filling of the east section was suspended to allow same to dry out and consolidate. Weekly records were made on three sections across the hydraulic fill of the depths to which a pole 1 inch in diameter could be forced by a pressure of 150 pounds.

Consolidation hubs have been driven over the slopes of the dam, about 250 feet apart parallel to the axis and about 100 feet apart transverse thereto. The elevations of these hubs are determined by Y level about the middle of each month.

#### GATUN SPILLWAY.

Until the beginning of the dry season in January work was confined to the east and west flanks of the spillway; it consisted prin-

cipally of the construction of the approach walls and excavation for same and in the forebay. About the middle of January the outflow from Gatun Lake had sufficiently diminished to permit proceeding with the foundation and other work at low levels. Cofferdams were erected on both sides of the channel of flow, within which excavation for foundations was completed and the concrete forming the foot of the ogee placed to an elevation above high water. Two additional small cofferdams were constructed to permit the placing of large blocks of concrete just outside the channel of flow. The construction and sluicing piers were carried to elevation +45 in January, and a combined standard and narrow gauge track placed thereon. By the end of the dry season the balanced valve and the three sluice-gate frames had been set and the concrete advanced so that construction could proceed according to the approved plan without interference by floods.

Excavation, including preparation of foundations, amounted to 157,628 cubic yards, making a total of 1,583,960 cubic yards taken from the spillway. This work is practically completed.

Concrete placed amounted to 59,651 cubic yards, making a total of 143,746 cubic yards. To complete the dam and walls connected therewith will require 81,254 cubic yards. Concrete work is 66 per cent completed.

Back fill behind the lower side walls amounted to 5,877 cubic yards of hard rock and 710 cubic yards of earth, making this item 32 per cent completed.

#### SPILLWAY-MINDI LEVEE.

The levee connecting Spillway Hill with Mindi Hill was completed in accordance with the approved plan. In addition the old Chagres River bed east of the levee crossing was filled by dredge *No. 86*, thus substantially reenforcing this section. Material placed amounted to 51,156 cubic yards of dry fill and 20,398 cubic yards of hydraulic fill, making the total amount 197,556 cubic yards.

#### *Comparative statement of costs—Dam and spillway.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
<b>GATUN SPILLWAY CONSTRUCTION.</b>						
Dry excavation.....cubic yards..	15,436	10,508	22,662	31,010	28,361	17,406
Drilling.....			\$0.0004	\$0.0057	\$0.0216	\$0.0395
Blasting.....			.0106	.0108	.0478	.0716
Loading by power.....	\$0.0586	\$0.0518	.0747	.0564	.0906	.1204
Tracks.....	.0100	.1273	.0644	.0294	.0420	.0719
Transportation.....	.0643	.0427	.0654	.0363	.0673	.0810
Trestles.....			.0035			
Maintenance of equipment.....	.0497	.0227	.0593	.0459	.0610	.0528
Plant arbitrary.....	.1100	.1100	.1100	.1100	.1100	.1100
Division expense.....	.0206	.0308	.0220	.0139	.0253	.0302
Total division cost.....	.3132	.3853	.4109	.3084	.4656	.5774
Preparing foundations, excavation, cubic yards.....	3,614	1,973	2,600	3,870	1,635	1,082
Loading by power.....	\$0.6086	\$0.7439	\$0.4556	\$0.0141	\$0.6284	\$0.0232
Loading by hand.....				.4604		.9256
Transportation.....				.0061		
Tracks (trestles).....		.0240				
Maintenance of equipment.....	.0215		.0023	.0159		.0365
Plant arbitrary.....	.1100	.1100	.1100	.1100	.1100	.1100
Division expense.....	.0692	.1009	.0548	.0571	.0601	.0786
Total division cost.....	.8293	.9788	.6227	.6636	.7985	1.1739

## Comparative statement of costs—Dam and spillway—Continued.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
<b>GATUN SPILLWAY CONSTRUCTION—contd.</b>						
<i>Masonry.</i>						
Concrete.....cubic yards..	2,232	3,237	4,250	7,234	5,522	5,597
Cement.....	\$1.9271	\$1.9014	\$1.7680	\$1.7660	\$1.7752	\$1.8694
Stone.....	2.7538	2.7330	2.0280	2.2052	2.3280	2.3753
Sand.....	.7079	.7138	.5376	.5337	.3735	.4479
Placing.....	.5566	.3204	.2413	.1533	.1812	.2064
Total cost.....	6.0054	5.6746	4.5749	4.6582	4.6589	4.8990
Large rock.....cubic yards..	284	336	171	181	129	
Cost.....	\$1.0342	\$1.8512	\$2.1869	\$2.7269	\$3.6477	
Masonry.....cubic yards..	2,516	3,573	4,421	7,415	5,651	5,597
Concrete.....	\$5.3274	\$5.1411	\$4.3980	\$4.5447	\$4.5526	\$4.8990
Large rock.....	.1167	.1741	.0846	.0665	.0832	.0172
Wood forms.....	.5778	.0465	.5235	.3676	.4761	.5513
Placing.....	.6831	.7612	.6207	.4409	.6804	1.0019
Cofferdams.....						.2397
Maintenance of equipment.....	.3616	.4351	.3393	.1551	.1643	.3425
Plant arbitrary.....	.6160	.6160	.6160	.6160	.6160	.6160
Division expense.....	.2631	.2546	.1501	.1116	.1216	.1180
Total division cost.....	7.9457	8.0286	6.7322	6.3024	6.6942	7.7512
Back filling.....cubic yards..	3,614	942	2,600			
Filling.....	\$0.0023		\$0.0365			
Plant arbitrary.....	.1100					
Division expense.....	.0003		.0043			
Total division cost.....	.1126		.0408			
<b>GATUN DAM CONSTRUCTION.</b>						
Dry fill.....cubic yards..	180,111	229,774	223,102	250,619	266,105	169,575
Excavation.....						\$0.0019
Clearing site.....	\$0.0056	\$0.0033	\$0.0068	\$0.0024	\$0.0010	.0042
Tracks.....	.0940	.0564	.0583	.0524	.0415	.0742
Trestles.....	.0028	.0042	.0078	.0092	.0153	.0412
Transportation.....	.0142	.0618	.1406	.0828	.0859	.0897
Filling.....	.0909	.0965	.0869	.0773	.0708	.1112
Maintenance of equipment.....	.0083	.0074	.0147	.0223	.0399	.0488
Plant arbitrary.....	.0770	.0770	.0770	.0700	.0700	.0717
Division expense.....	.0251	.0222	.0192	.0145	.0119	.0149
Total division cost.....	.3179	.3288	.4113	.3309	.3363	.4578
Hydraulic fill.....cubic yards..	462,092	406,606	457,637	480,732	129,666	243,121
Clearing site.....	\$0.0056	\$0.0033	\$0.0068	\$0.0024	\$0.0010	\$0.0042
Clearing for dredges.....	.0069	.0084	.0054	.0143	.0246	.0044
Dredging.....	.0644	.0594	.0729	.0668	.1334	.0804
Relay pumps.....	.0026	.0023	.0008	.0012	.0091	.0104
Pipe lines.....	.0268	.0111	.0179	.0097	.0598	.0239
Wood flumes.....				.0038	.0124	.0005
Power.....	.0124	.0130			.0539	.0388
Small boats.....	.0010	.0011	.0014	.0010	.0055	.0023
Maintenance of equipment.....	.0321	.0428	.0108	.0160	.2573	.0373
Plant arbitrary.....	.0490	.0490	.0490	.0470	.0470	.0470
Division expense.....	.0084	.0090	.0057	.0078	.0202	.0068
Total division cost.....	.2092	.1995	.1707	.1700	.6242	.2560
Paving.....cubic yards..	7,602	5,236	5,536			
Clearing site.....	\$0.0056	\$0.0033	\$0.0068			
Filling.....	.2118	.1031	.2056			
Plant arbitrary.....	.0770	.0770	.0770			
Division expense.....	.0800	.0140	.0160			
Total division cost.....	.3244	.1974	.3054			



## Comparative statement of costs—Dam and spillway—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.
<b>GATUN SPILLWAY CONSTRUCTION.</b>						
Preparing foundations, excavation, cubic yards.....	5,636	6,881	1,010	1,778	2,051	115
Cofferdams.....		\$0.3848	\$0.9179	\$0.2376	\$0.6061	\$5.8043
Drilling.....	\$0.1199	.0675		.0777		
Blasting.....	.0632	.0462		.0301		
Loading by power.....	.0616	.1479	.1995	.2740	.2182	.9983
Loading by hand.....	.5274	.6129	2.0237	.4310	1.2793	11.6028
Transportation.....	.2712	.3210	.2085	.0435	.0206	
Tracks (trestles).....	.2914	.0865		.0195	.0213	.2978
Pumps (power).....	.0196	.0445			.0042	
Maintenance of equipment.....	.1751	.1920	.0094	.0355	.2081	.9937
Plant arbitrary.....	.1190	.1190		.1190	.1190	.1190
Division expense.....	.1068	.0658	.0809	.0619	.1538	1.6020
Total division cost.....	1.7552	2.0981	3.2199	.7818	2.6306	21.4179
<b>Masonry.</b>						
Concrete.....cubic yards.....	2,510	6,609	8,704	4,169	3,656	4,830
Cement.....	\$1.7053	\$1.7972	\$1.7660	\$1.9118	\$1.6243	\$1.7286
Stone.....	1.0256	1.6778	1.6079	1.6440	1.0915	1.7076
Sand.....	.3805	.7679	.6689	.8328	.6247	.6766
Mixing.....	.3102	.1679	.1764	.3250	.2959	.2741
Total cost.....	4.0216	4.4108	4.2192	4.7136	4.2364	4.3869
Masonry.....cubic yards.....	2,510	6,609	8,704	4,169	3,656	4,830
Concrete.....	\$4.0216	\$4.4108	\$4.2192	\$4.7136	\$4.2364	\$4.3869
Large rock.....		.0142				
Wood forms.....	1.8870	.6734	.3315	.5776	1.0276	.5220
Placing.....	1.2746	.4204	.5358	.4298	.6132	.4004
Cofferdams.....	.8557	.3924	.0355	.2703	.1546	.0461
Reinforcements.....				.0006	.0020	.0933
Pumps.....	.0147	.0154		.0122		
Maintenance of equipment.....	.3812	.1129	.2036	.2807	.0550	.1076
Plant arbitrary.....	.4670	.4670	.4670	.4670	.4670	.4670
Division expense.....	.2416	.0527	.0461	.1184	.0880	.0869
Total division cost.....	9.1434	5.7744	5.8387	6.8702	6.3346	6.1702
<b>Back filling.....cubic yards.....</b>						
Excavation.....				\$1.2414	\$0.0449	\$0.0679
Tracks.....				3.0818	.5523	.2324
Filling.....				.0514	.1756	.1741
Plant arbitrary.....						.0227
Division expense.....				.2502	.0322	.0312
Total division cost.....				4.6248	.8050	.5283
<b>GATUN DAM CONSTRUCTION.</b>						
Dry fill.....cubic yards.....	218,690	211,008	255,047	205,130	207,751	227,996
Excavation.....	\$0.0148	\$0.0066	\$0.0118	\$0.0279	\$0.0255	\$0.0287
Clearing site.....	.0014	.0006	.0004	.0007	.0005	.0006
Tracks.....	.0545	.0481	.0395	.0473	.0537	.0332
Trestles.....	.0307	.0008	.0063	.0134	.0013	.0018
Transportation.....	.0218	.1270	.0854	.1358	.1113	.1149
Filling.....	.0815	.0834	.0678	.0900	.0922	.0848
Maintenance of equipment.....	.0382	.0512	.0493	.0456	.0259	.0274
Plant arbitrary.....	.0332	.1001	.0986	.0979	.0946	.0966
Division expense.....	.0139	.0090	.0086	.0112	.0120	.0127
Total division cost.....	.3500	.4257	.3609	.4698	.4170	.4007
Hydraulic fill.....cubic yards.....	211,992	301,733	342,800	368,658	419,348	432,008
Clearing site.....	\$0.0014	\$0.0006	\$0.0004	\$0.0007	\$0.0005	\$0.0006
Clearing for dredges.....	.0092	.0211	.0213	.0123	.0070	.0034
Dredging.....	.0936	.0761	.0644	.0693	.0685	.0678
Relay pumps.....	.0114	.0095	.0120	.0088	.0139	.0077
Pipe lines.....	.0836	.0146	.0226	.0084	.0110	.0449
Wood flumes.....	.0268		.0036	.0018	.0026	.0028
Power.....	.0303	.0450	.0421	.0374	.0450	.0428
Small boats.....	.0021	.0017	.0017	.0023	.0015	.0016
Maintenance of equipment.....	.0458	.0324	.0441	.0194	.0678	.0325
Plant arbitrary.....	.0500	.0500	.0499	.0500	.0500	.0500
Division expense.....	.0074	.0042	.0051	.0045	.0042	.0044
Total division cost.....	.3616	.2552	.2664	.2149	.1370	.2585

Figures in heavy-face type are credits.

## MUNICIPAL ENGINEERING.

[Mr. L. G. Thom, superintendent, in local charge.]

## GATUN WATERWORKS.

The only change or alteration to the system was the erection of a small pumping station on Gatun Lake, to be used in case of interruption to the regular service. This plant was installed on a small concrete platform built above high-water level of the lake. The machinery consists of three steam pumps and one motor-driven centrifugal pump taken from the old pumping station. This station was operated about two months to furnish water, under 140 pounds pressure, for sluicing at Mindi and in the lower lock.

During the dry season, the consumption of water increased to such an extent that the pressure at points distant from the water tank was not sufficient for ordinary purposes. The 10-inch pipe taken from the old pump station was laid from the Agua Clara station to the north end of the locks, furnishing water direct to the machine shop, power plant, and Mindi. Since the installation of this line, no trouble whatever has been experienced through the lack of pressure.

The usual work of shifting, relaying, and maintenance of the pipe lines was carried on. The following table gives the amount of pipe handled during the year:

*Pipe handled.*

	Feet.		Feet.
$\frac{3}{4}$ -inch -----	980	4 $\frac{1}{2}$ -inch -----	980
1-inch -----	1, 972	5-inch -----	9, 715
1 $\frac{1}{4}$ -inch -----	612	6-inch -----	3, 219
1 $\frac{1}{2}$ -inch -----	2, 968	7-inch -----	3, 447
2-inch -----	582	8-inch -----	4, 873
2 $\frac{1}{2}$ -inch -----	2, 082	10-inch -----	8, 900
3-inch -----	3, 612		
4-inch -----	4, 784	Total -----	48, 760

## AGUA CLARA RESERVOIR.

This reservoir was described in the annual report for 1909. The banks of the reservoir have been cleared of all brush and rubbish, and everything is now in first-class condition. The following table shows the consumption of water from this reservoir for the year:

*Water from Agua Clara Reservoir.*

	Gallons.		Gallons.
July -----	58, 989, 000	March -----	92, 656, 000
August -----	67, 452, 000	April -----	85, 644, 000
September -----	62, 924, 000	May -----	89, 701, 000
October -----	66, 951, 000	June -----	101, 824, 000
November -----	69, 201, 000		
December -----	81, 936, 000	Total -----	935, 098, 000
January -----	79, 565, 000	Daily average -----	2, 561, 000
February -----	80, 254, 000		

The water in the reservoir began to fall on December 27 and continued until May 8, when it reached elevation 55.9. There was then available for use, in the reservoir, 297,280,000 gallons, enough for 115 days at the average daily rate of consumption for the year. During the dry season of 125 days the water fell from elevation 68.5 to 55.9, 12.6 feet.

The rainfall for the year at this reservoir was:

*Rainfall, Agua Clara Reservoir.*

	Inches.		Inches.
July-----	17. 20	March-----	. 95
August-----	11. 21	April-----	4. 66
September-----	14. 00	May-----	22. 96
October-----	12. 08	June-----	14. 79
November-----	27. 14		
December-----	22. 65	Total-----	150. 69
January-----	. 70	Daily average-----	+ . 41
February-----	2. 25		

AGUA CLARA FILTER PLANT.

[See Plate 103.]

A rapid gravity mechanical filter plant was authorized January 21, 1911, to consist of—

A settling basin, 70 by 70 feet, 10 feet deep, divided into four compartments and provided with an influent and an effluent trough.

A mixing box, 31 feet 6 inches by 5 feet, 7 feet 6 inches deep, divided into eight compartments. This mixing box will be provided with girds for applying the coagulant.

A filter house, 41 by 54 feet, three stories high, containing four filters, 17 by 17 feet, having a normal capacity of 825,000 gallons each per day, or a combined maximum capacity of 3,300,000 gallons per day. This building contains also two solution tanks, 9 feet square and 7 feet deep. The lower floor, the operating mechanism, and the third floor provide storage for six months' supply of aluminum sulphate.

A covered clear-water well, 50 by 50 feet, 12 feet 6 inches deep, 200,000 gallons capacity.

An office and laboratory for the use of the filter operator.

All the buildings in this plant are constructed of reenforced concrete. Work was commenced on this plant on January 24, 1911. The concrete-construction work is about 94 per cent completed, and the filter plant as a whole, including installation of piping and filter apparatus, is about 80 per cent completed.

The following table shows the work done:

Concrete placed in—	ubic yards.
Clear-water well-----	284. 1
Settling basin-----	421. 5
Filter house-----	414. 1
Total-----	1, 119. 7

## Work remaining to be done:

	Cubic yards.
Construction of laboratory-----	45
Stairways, office, etc-----	10
Walks, gutters-----	10
Total-----	65

Installation of filter apparatus and piping, pipe connections to settling basin and pump house, back fill, and cleaning up.

The concrete work will be finished by the 1st of August, and the plant should be ready for operation about the 1st of October.

## SEWERS.

Sewers were extended from time to time, a total of 4,425 feet. Usual maintenance work carried on. The entire system was flushed, generally twice a month.

Fifty-three new house connections were installed.

## SANITARY MAINTENANCE.

On request from the sanitary department, 197,834 feet of ditches were cleaned and graded; also 29,160 feet of road ditches were cleaned.

## ROADS.

A 16-foot macadam road was constructed from the incinerator to New Gatun, a distance of 1,400 feet; a 12-foot road, 650 feet long, was constructed from the corral to the lumber yard for fire protection; a 3-foot culvert was built to replace the wooden bridge on the road entering the corral; 101 feet of this road was rebuilt.

About 3,100 feet of curb and gutter were constructed along streets in Gatun. About 10,000 cubic yards of macadam and 3,000 square yards of cinders were placed on the roads and paths in repair work during the year.

## DITCH AND LEVEE WORK.

Certain ditches and levees were constructed near Mindi providing for changes in drainage made necessary in the disposition of the hydraulic dredge excavation in the canal between Gatun and Mindi. In this work 6,013 cubic yards of fill and 11,115 cubic yards of excavation were made by steam shovel and 4,176 cubic yards of excavation by hand.

## COLON.

## WATERWORKS.

No changes were made in this system during the year. The usual repairs to breaks, leaks, valves, etc., was carried on as needed.

## MOUNT HOPE PUMPING STATION AND FILTRATION PLANT.

The plant was successfully operated during the year. No changes or alterations were made.

The attached table gives the amount of water pumped and filtered at this plant.

*Mount Hope filter and Brazos Brook reservoir.*

Months.	Rain-fall.	Elevation reservoir.	Alkalinity per million.		Coagulant aluminum sul- phate.	Turbidity per million.		Color per million.	
			Raw.	Fil- tered.		Raw.	Fil- tered.	Raw.	Fil- tered.
<hr/>									
1910.	<i>Inches.</i>	<i>Feet.</i>			<i>Pounds.</i>				
July.....	21.59	49.3	22.0	9.0	15,672	50	0	55	0
August.....	13.57	48.5	22.0	8.0	14,210	50	0	45	0
September.....	12.21	47.0	21.8	8.5	13,530	40	0	50	0
October.....	8.91	47.9	21.5	7.1	14,105	40	0	75	0
November.....	29.20	49.5	21.4	6.5	14,055	35	0	70	0
December.....	20.75	49.2	20.5	7.2	15,531	35	0	65	0
<hr/>									
1911.									
January.....	1.00	46.6	16.2	7.0	15,035	40	0	60	0
February.....	2.04	44.1	16.5	5.0	14,210	50	0	80	0
March.....	1.28	40.4	16.5	3.0	18,755	35	0	85	5
April.....	3.91	37.4	17.0	2.0	19,500	25	0	85	5
May.....	19.87	39.9	20.0	6.0	18,600	20	0	80	0
June.....	16.12	43.3	22.0	11.5	17,400	15	0	65	0
Total.....	150.45				190,603				
<hr/>									
Months.	Odor.		Bacteria per cubic centimeter.		Wash water.	Monthly consumption.			
	Raw.	Fil- tered.	Raw.	Fil- tered.					
<hr/>									
1910.					<i>Gallons.</i>	<i>Gallons.</i>			
July.....	Vegetable and fishy...	Veg.	389	125	2,400,000	63,735,000			
August.....	do.....	Veg.	261	91	2,000,000	59,696,000			
September.....	do.....	0	208	21	2,158,000	64,745,000			
October.....	Vegetable.....	0	229	26	2,410,000	64,367,000			
November.....	do.....	0	283	91	2,510,000	64,918,000			
December.....	do.....	0	550	115	2,268,000	71,077,000			
<hr/>									
1911.									
January.....	Vegetable and fishy...	0	725	79	2,205,000	70,739,000			
February.....	do.....	0	950	75	2,106,000	59,696,000			
March.....	do.....	0	1,050	86	2,307,521	72,132,000			
April.....	do.....	0	1,810	279	2,121,871	66,217,000			
May.....	do.....	0	450	44	2,625,000	62,706,000			
June.....	do.....	0	421	49	2,529,000	62,762,000			
Total.....					27,640,392	787,271,000			

## BRAZOS BROOK RESERVOIR.

There is a much heavier draft on the reservoir at all times than is shown by the daily pumping reports, due to seepage. The fall of the water in the reservoir commenced on December 24, 1910, and continued until May 10, 1911, 138 days. At the beginning of the dry season the elevation was 49.5, the elevation of the spillway, and at the close it was 37, a fall of 12.5 feet. The amount of water drawn, including seepage, from the reservoir during this period was 466,100,000 gallons, a daily average of 3,377,000 gallons.

## COLON IMPROVEMENTS.

## WATER-DISTRIBUTION SYSTEM.

Water lines were completed on Hudson Lane, Second Street, Eighth Street, and Fourteenth Street. The lines on Second Street and Hud-

son Lane were laid on a bench in the sewer trench. The following table gives the work done:

Streets.	Water pipe.	Fire hydrant.	House connection.	Lead pipe.
Hudson Lane.....	3,286	12	212	2,544
Second Street.....	11,708	2		
Eighth Street.....	695			
Fourteenth Street.....	550			

## SEWER SYSTEM.

The only sewer work completed to date is that through Hudson Lane and the connection from Hudson Lane and Eighth Street to the sump at D Street.

## D STREET STORM SEWER.

This sewer was completed along the general lines noted in annual report of 1910. The following table gives quantities of material handled:

Work.	1910	1911	Total.
	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>
Excavation.....	6,473	12,881	19,354
Back fill.....	1,081	7,235	8,316
Reenforced concrete.....	1,628	5,000	6,628

## HYDRAULIC FILL.

The fill was started October 31, with dredge *No. 84*, which was later exchanged for dredge *No. 86*. The original plan of making the fill was to have the dredge work its way from Folks River parallel to G Street to a point about Seventh and H, widening out the cut in this locality, forming a lake. This would have given a shorter pipe line and a greater output from the dredge than that obtained. Unfortunately, so much coral rock was encountered that the plan had to be abandoned and the material pumped largely from Folks River. This involved a maximum length of pipe line of 7,000 feet. The total amount of fill to date is approximately 501,786 cubic yards.

Table showing division costs of material in place, exclusive of plant, is given below:

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
Preliminary surveys.....	\$0.0027	\$0.0015	\$0.0026	\$0.0038	\$0.0010	\$0.0016	\$0.0027	\$0.0018	
Operation dredge Sandpiper.....	.2472								
Repairs dredge Sandpiper.....	.0218								
Operation dredge No. 86.....	.1542	.1901	.1042	.2346	.1321	.1715	.1677	.1601	
Repairs dredge No. 86.....	.0831	.0549	.0089	.0075	.0001	.0091	.0165	.0094	
Pipe lines.....	.1763	.0820	.0307	.0189	.1154	.0594	.0180	.0082	
Division expense.....	.0148	.0115	.0050	.0057	.0042	.0063	.0061	.0071	
Total division cost.....		.4418	.3400	.1514	.2705	.2528	.2479	.2110	.1866

## DRAINAGE SYSTEM.

The drainage system south of Ninth Street is completed, and only a small amount of work remains to be done north of that street.

## PAVING.

Paving on D Street was completed, except half a block between Thirteenth and Fourteenth Streets. Much trouble was experienced on this street, due to the soft subgrade, consequently the surface of this street is rather uneven and some work will have to be done later in bringing it up to grade.

The section south of Ninth Street to and including Thirteenth Street has been covered with rock, but the surfacing has not been completed. It is thought advisable to wait until the dry season to do any paving north of Ninth Street. Ten thousand nine hundred and eighteen cubic yards of rock have been expended in street paving.

A total of 23,800 feet of curb and gutter were placed during the year.

## TORO POINT.

## WATER SUPPLY.

This work was completed along the general lines described in the annual report for 1910.

## MATERIAL PLACED IN DAMS.

	Cubic yards.
Dam No. 1-----	7,033
Dam No. 2-----	13,558
Dam No. 3-----	32,558
Diversion dam, Nombre Falls-----	717
Covering, bottom reservoir-----	3,910
Excavation in cut-off trench-----	1,678
Total -----	59,454

Dams 1, 2, and 3, built for impounding water in the storage reservoir, were not sufficiently advanced before the end of the rainy season of 1910 to enable the storage of the amount of water anticipated. The supply, however, from the diversion dam at Nombre Falls was sufficient to supply all needs until March 17, 1911, when a break in the pipe line below the diversion dam occurred. This drained the water stored by such dam, and also that stored in the main reservoir, before repairs could be made. Water was hauled from Cristobal by boat from March 18 to May 15. From 30,000 to 60,000 gallons per day were supplied in this manner. A gradually decreasing supply was obtained from the diversion dam during this period. The principal storage reservoir was completed in April and the storage of water commenced on May 18. On June 30, 4,000,000 gallons had been stored. A small pump was installed in January to pump salt water to supply the range closets and the laborers' camps. This pumping was continued until June 27.

## ROADS.

A road 1,680 feet long of coral, crushed rock, and sand was built in the rear of the gold quarters from the dock to the end of the laborers' camp.

## TRANSPORTATION.

The following is a list of equipment in the transportation service of the Atlantic division June 30, 1911:

## Standard-gauge equipment:

American locomotives.....	18
French, Roger type, and old Panama R. R. locomotives.....	25
Wrecking crane No. 64.....	1
Track shifters.....	3
Passenger coaches, Gatun-Culebra labor train.....	2
Box cars—	
Used as labor cars.....	14
Used as bunk cars.....	2
Used on wrecking crane as supply car.....	1
Rogers ballast cars, rock and sand service, auxiliary mixer.....	26
Steel flat standard-gauge cars.....	25
Wooden flat standard-gauge cars.....	5
18-yard Western dump cars.....	105
19-yard Oliver dump cars.....	48
12-yard Oliver dump cars.....	33
12-yard Western dump cars.....	58
Lidgerwood unloaders.....	1
Lidgerwood side flat cars.....	20

## Narrow gauge:

Locomotives—	
3-foot 6-inch gauge.....	10
3-foot gauge.....	11
6-yard Oliver dump cars.....	75
Narrow-gauge Western dump cars.....	36
Narrow-gauge flats.....	28

Respectfully submitted.

WM. L. SIBERT,  
*Division Engineer, Atlantic Division.*

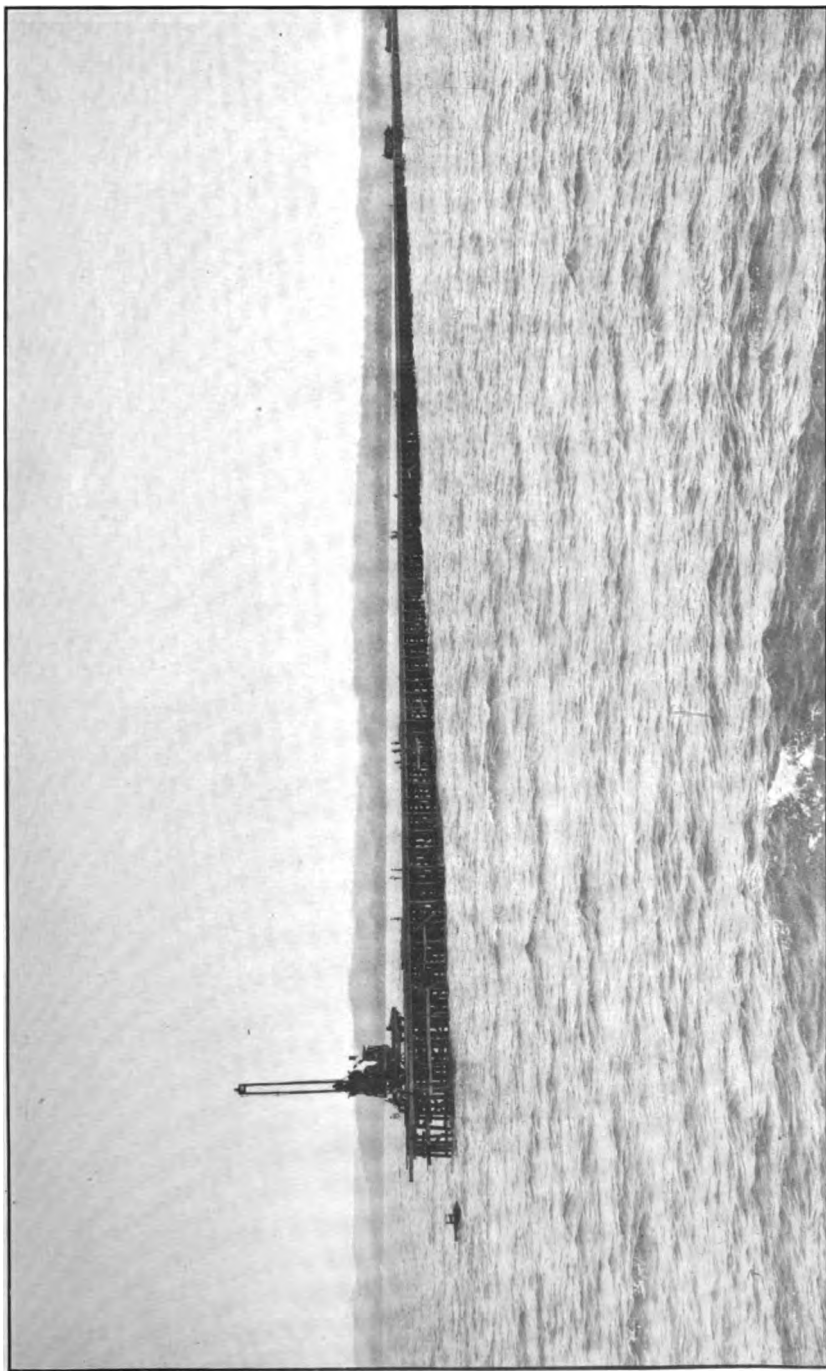
Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*



## APPENDIX TO APPENDIX B.

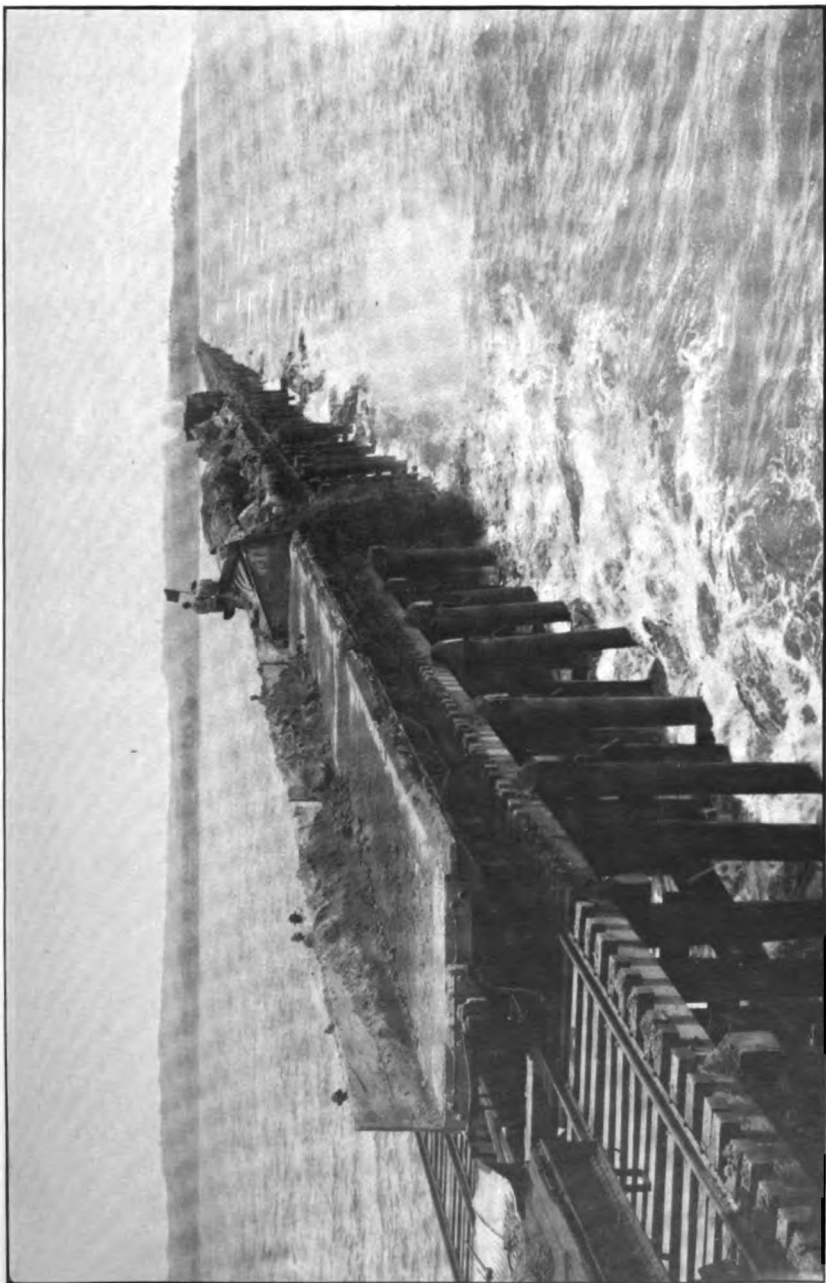
*Progress report for fiscal year 1910-11, Atlantic Division.*

	Locks.	Dam and spillway.	Mindl.	Dredging.	Porto Bello.	Nombre de Dios.	Municipal engineering.	Breakwater.	Total.
Steam shovel excavation:									
In prism.....cubic yards.	650,091		308,910						959,601
Auxiliary.....do.	169,024	157,628			233,300			359,890	919,842
Dredge excavation:									
In prism.....do.				5,828,345		103,600			5,828,345
Auxiliary.....do.									103,600
Total excavation.....	819,715	157,628	308,910	5,828,345	233,300	103,600		359,890	7,811,388
Explosives used.....tons, 2,240 pounds	40.9		23.99	172.35	365.38	.41	1.02		290.24
Power drilling.....feet.	325	62.55	19,038	49,541	172,236			124,375	365,515
Hand drilling.....do.	327,919		52,961				570	91,797	473,247
New track laid.....do.	39,572	59,567	9,300		30,022		776	28,540	167,777
Material placed in dams.....yards		6,928,875							6,928,875
Cement received.....barrels	945,526	58,696			264		7,050		1,011,536
Cement used.....do.	909,652	57,505			264		8,021		1,011,536
Cement on hand.....do.									1,011,536
Stone received.....yards	819,818	53,847			115		17,831		891,611
Stone used.....do.	733,842	54,816			115		18,063		806,856
Stone on hand.....do.									
Sand dredged.....do.						442,003			442,003
Sand received.....do.	432,513	21,280			34		6,387	460,214	460,214
Sand used.....do.	378,816	20,442			34		2,917	402,209	402,209
Sand on hand.....do.									
Rock crushed.....do.					864,087				864,087
Concrete placed.....feet b. m.	911,137	59,651			106		7,028		978,612
Lumber used.....do.	12,204,180						315,704	616,814	932,518
Lumber on hand.....do.							326,353	1,018,913	13,549,446
Forms, steel, erected.....tons	19,791.95						139.15		19,931.10
Forms, wooden, erected.....square feet	1,996,716						41,978		2,038,694
Steel work placed.....tons	3,904.59						4,502		4,406.59
New roads built.....feet							33,518		33,518
Water mains laid.....do.							87,783	380	88,163
Sewers laid.....do.							12,959	176	13,135
Open drains and ditches dug and cleaned.....do.							149,754	17,340	167,094
Average daily force employed.....inches	3,323	1,367	241	1,481	644	245		505	8,310
Rainfall.....	152.21	152.21	152.21		164.08				



TORO POINT BREAKWATER FROM THE SEA. ONE MILE OF TRESTLE COMPLETED, JULY, 1911.





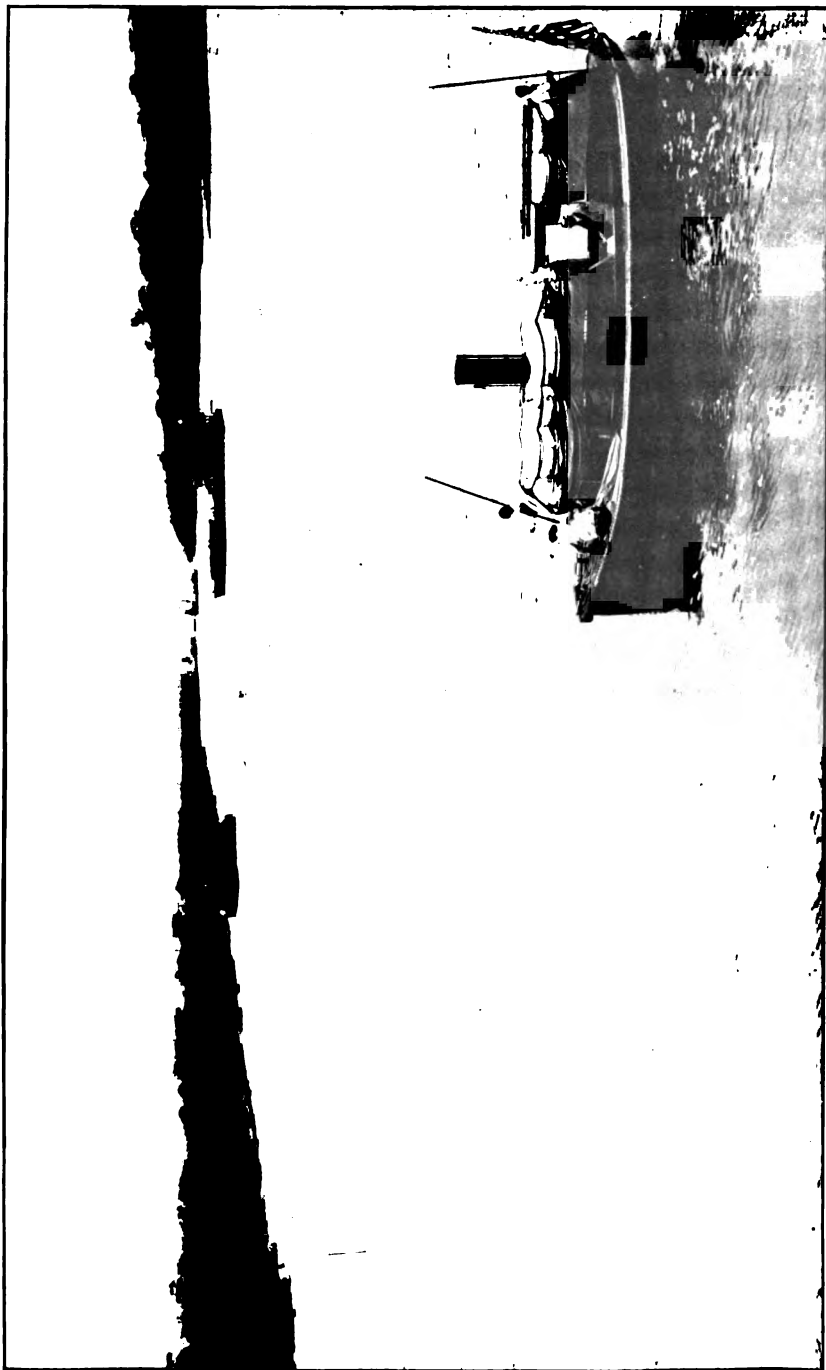
TORO POINT BREAKWATER LOOKING TOWARD LIGHTHOUSE, SHOWING CONSTRUCTION OF THE BREAKWATER AND METHOD OF UNLOADING ROCK FROM CARS, JULY, 1911.





TORO POINT QUARRY. LOADING ROCK ON LIDGERWOOD FLAT CARS FOR THE BREAKWATER, JULY, 1911.

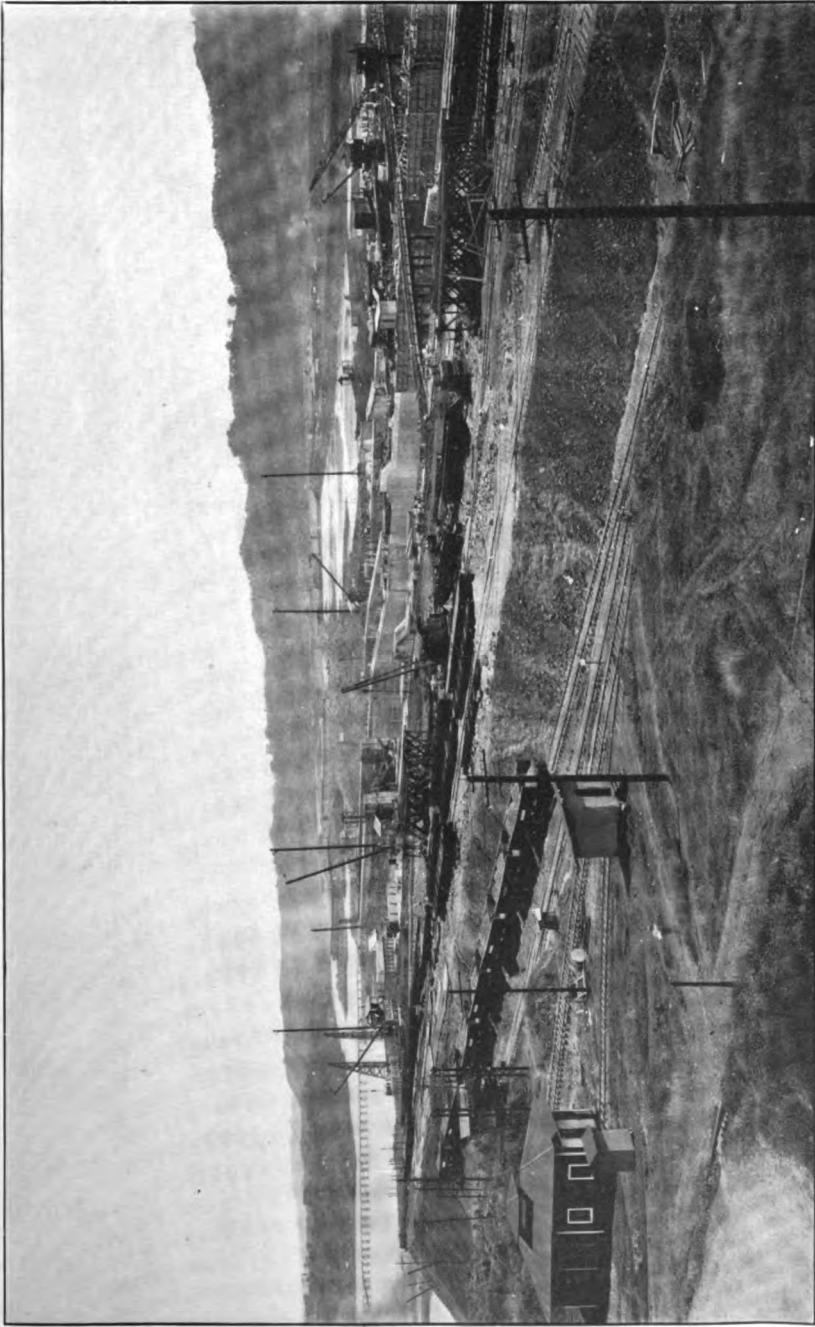




ATLANTIC ENTRANCE TO THE CANAL LOOKING SOUTH TOWARD GATUN, SHOWING COMPLETED SECTION OF THE MAIN CHANNEL  
FIVE HUNDRED FEET WIDE, JULY, 1911.



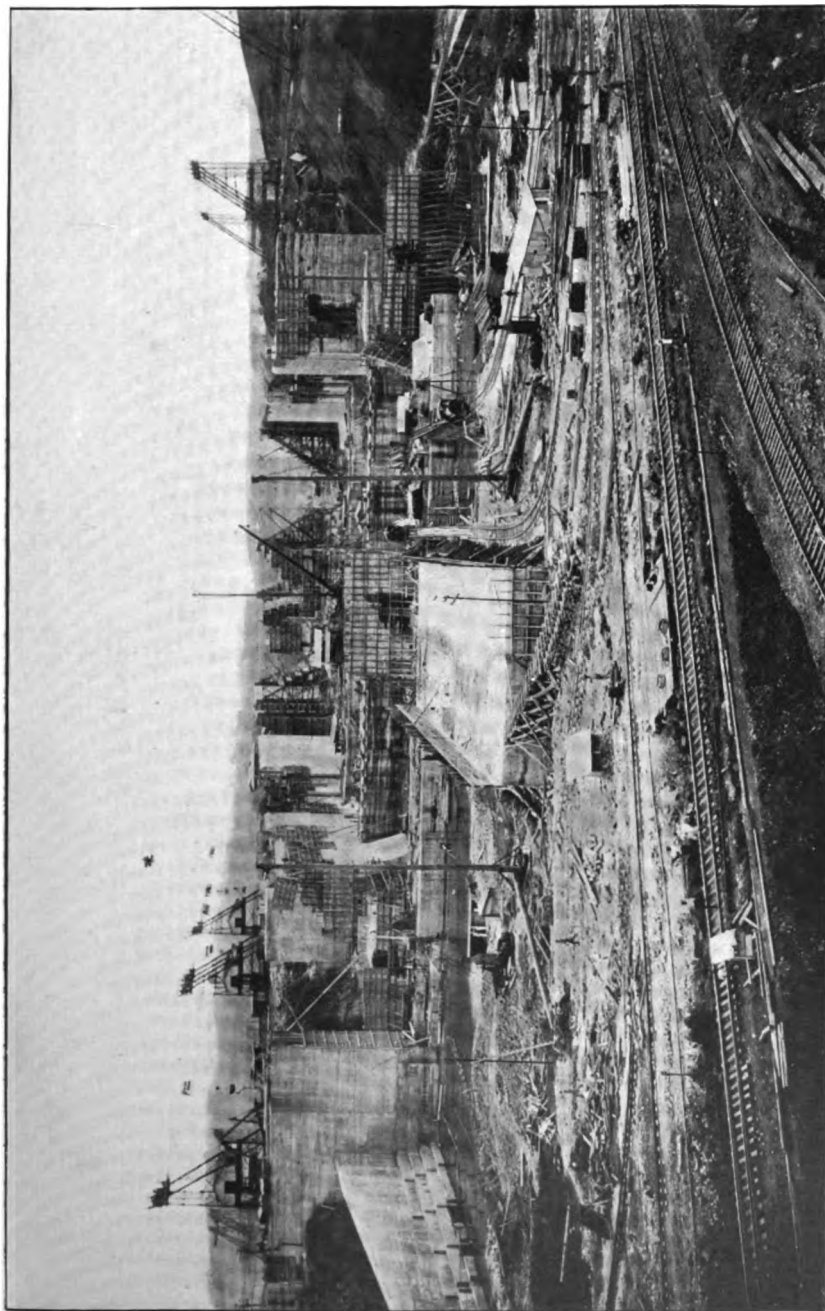




GATUN LOCKS LOOKING WEST, SHOWING UPPER END OF LOCKS WITH GATUN DAM AND SPILLWAY WALLS IN THE DISTANCE, JUNE 16, 1911.



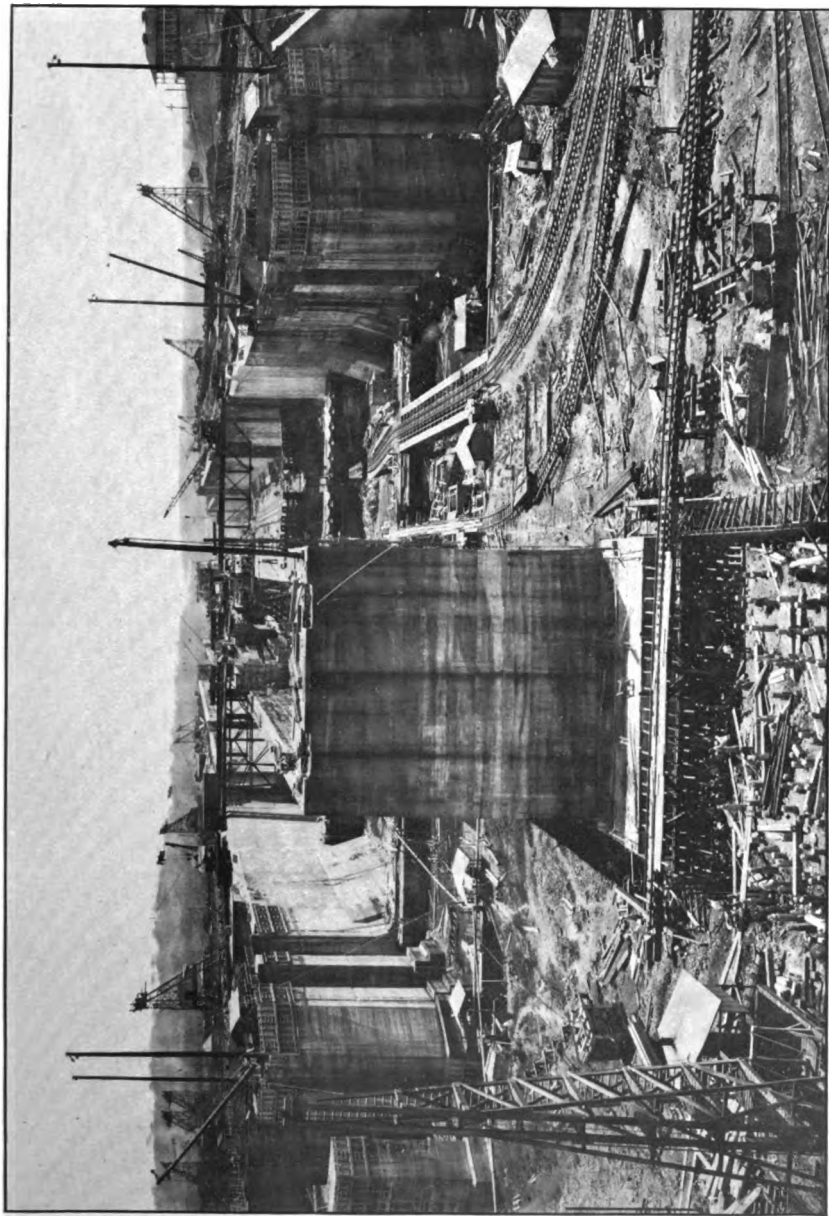
PLATE 9.



GATUN LOCKS LOOKING NORTH, SHOWING THE FOREBAY AND WORK IN PROGRESS IN THE UPPER LOCKS, JULY 16, 1910.



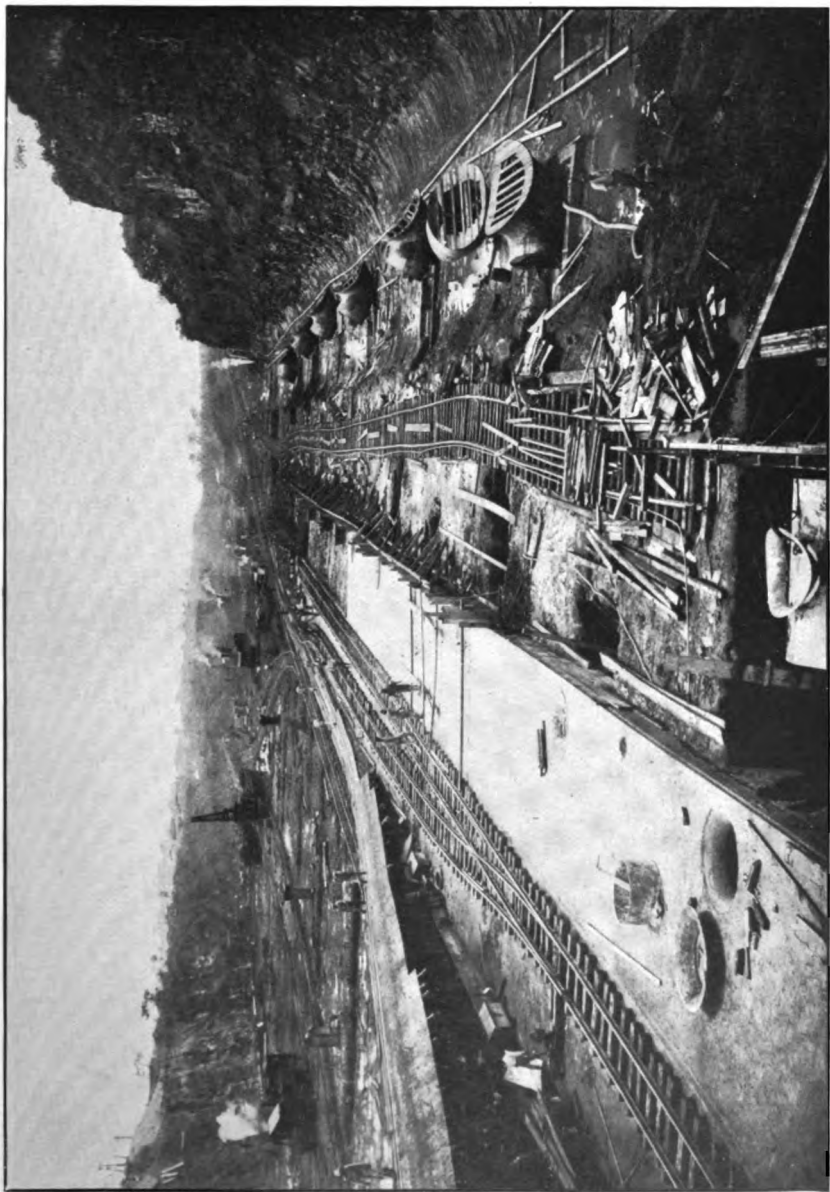
PLATE 10.



GATUN UPPER LOCKS AND FOREBAY LOOKING NORTH, JUNE 16, 1911.



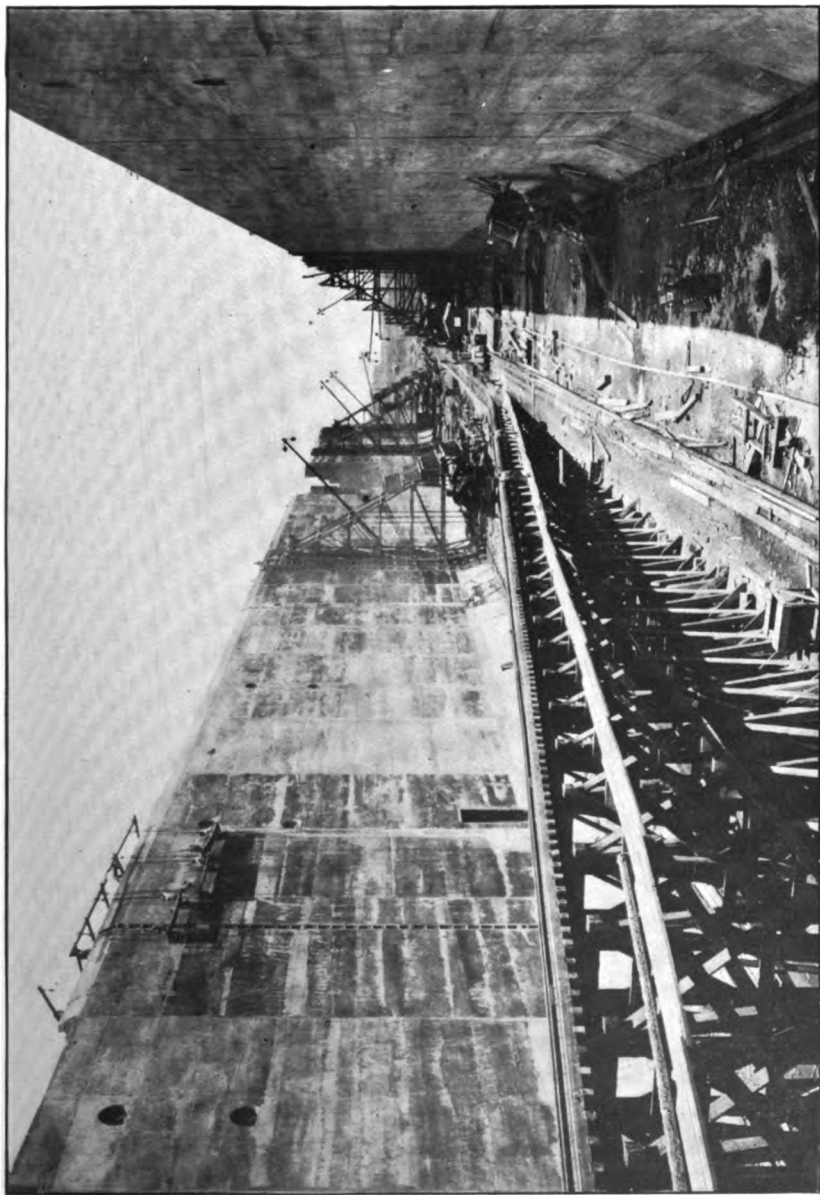
PLATE 11.



GATUN LOCKS LOOKING NORTH, SHOWING THE COMMENCEMENT OF FLOOR CONSTRUCTION IN THE MIDDLE LOCK, JULY 2, 1910.



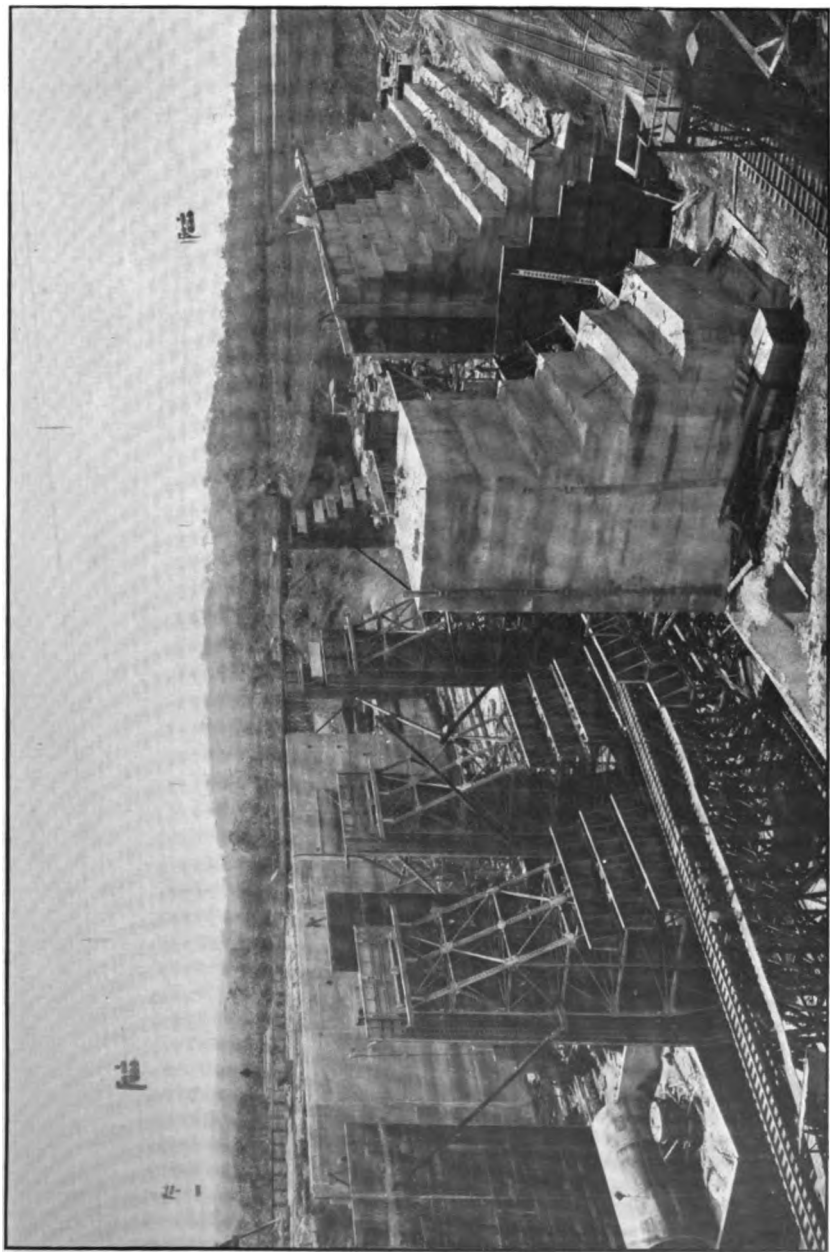




GATUN LOCKS. SAME VIEW AS PRECEDING ONE. TEN MONTHS LATER, SHOWING MIDDLE LOCK PRACTICALLY COMPLETED, APRIL 1, 1911.

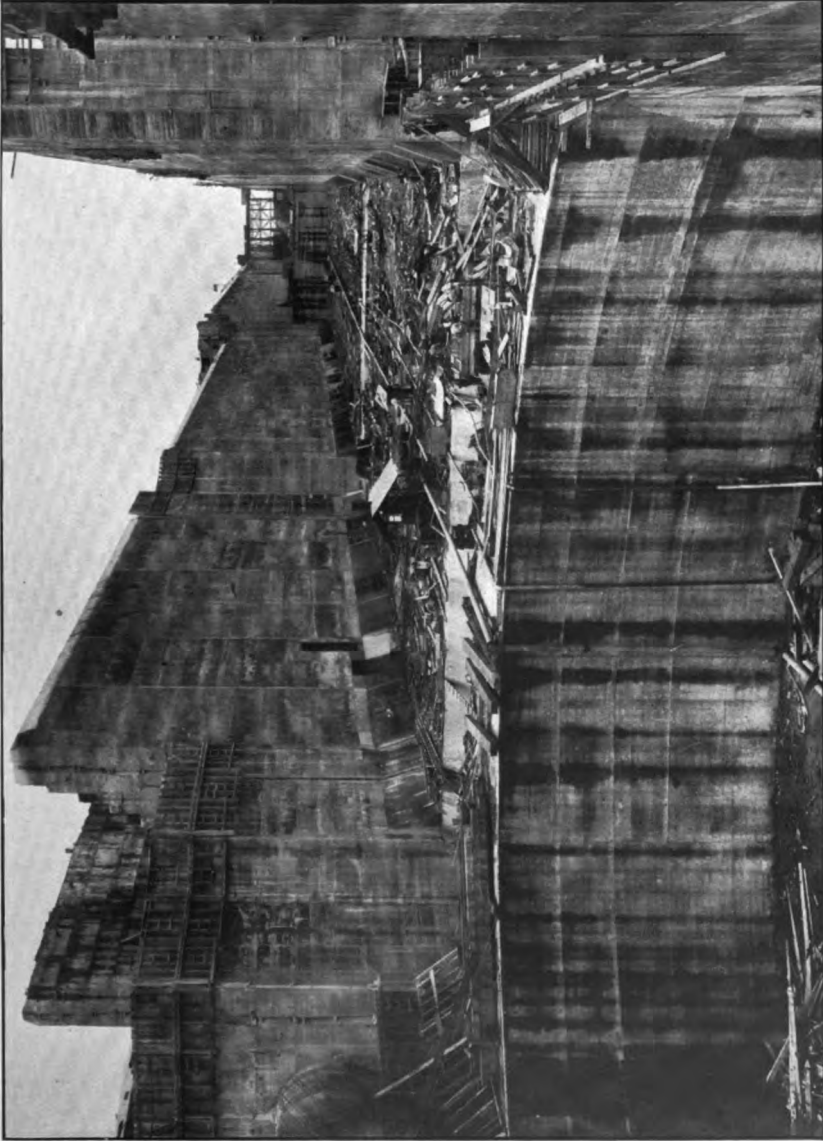


PLATE 13.



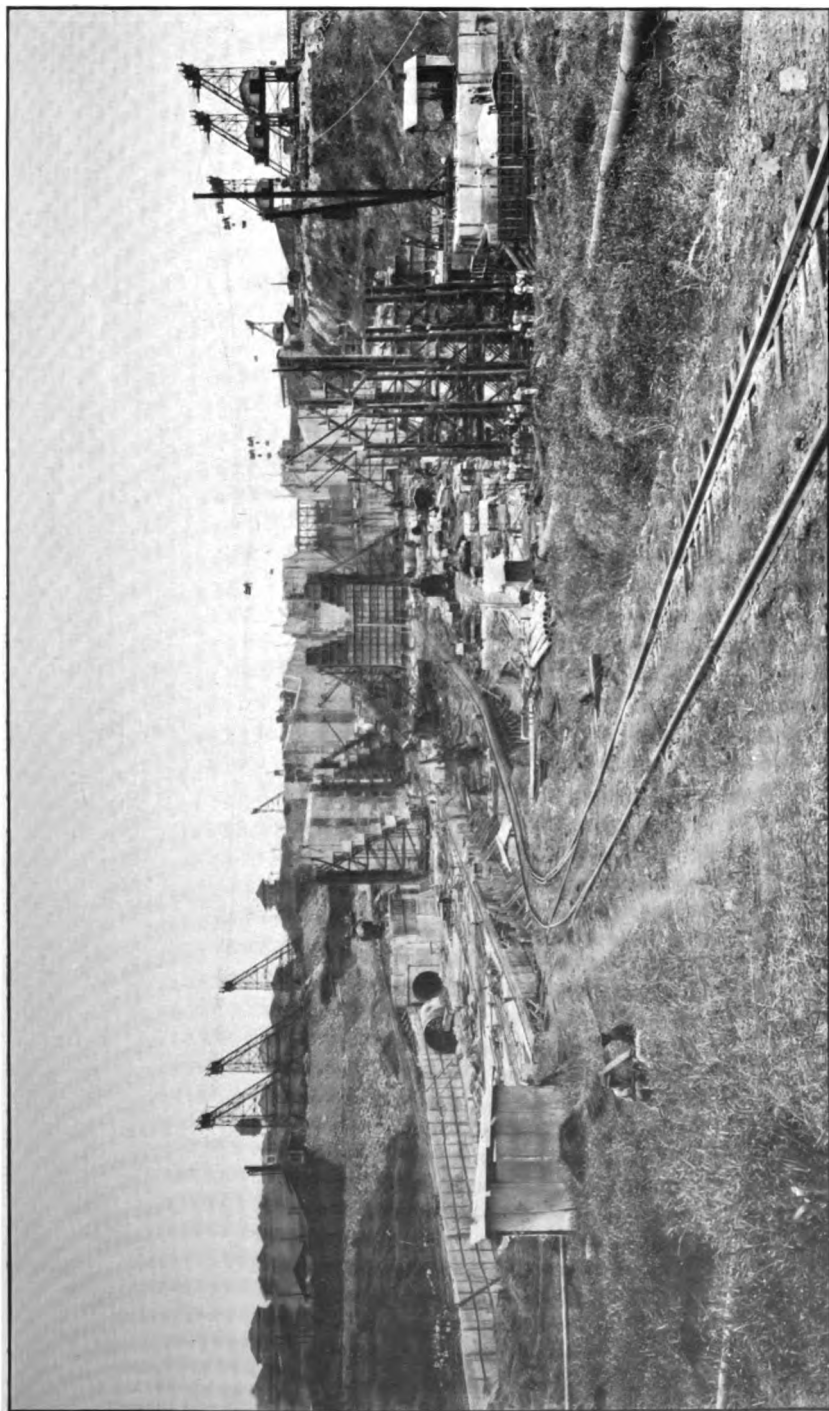
GATUN LOCKS LOOKING NORTH FROM EAST WALL, SHOWING PROGRESS OF CONSTRUCTION IN LOWER LOCKS, JUNE 16, 1911.





GATUN LOCKS LOOKING SOUTH, SHOWING WEST CHAMBER OF MIDDLE LOCK, WITH UPPER LOCK AND UPPER GUARD GATES IN DISTANCE, JULY 5, 1911.

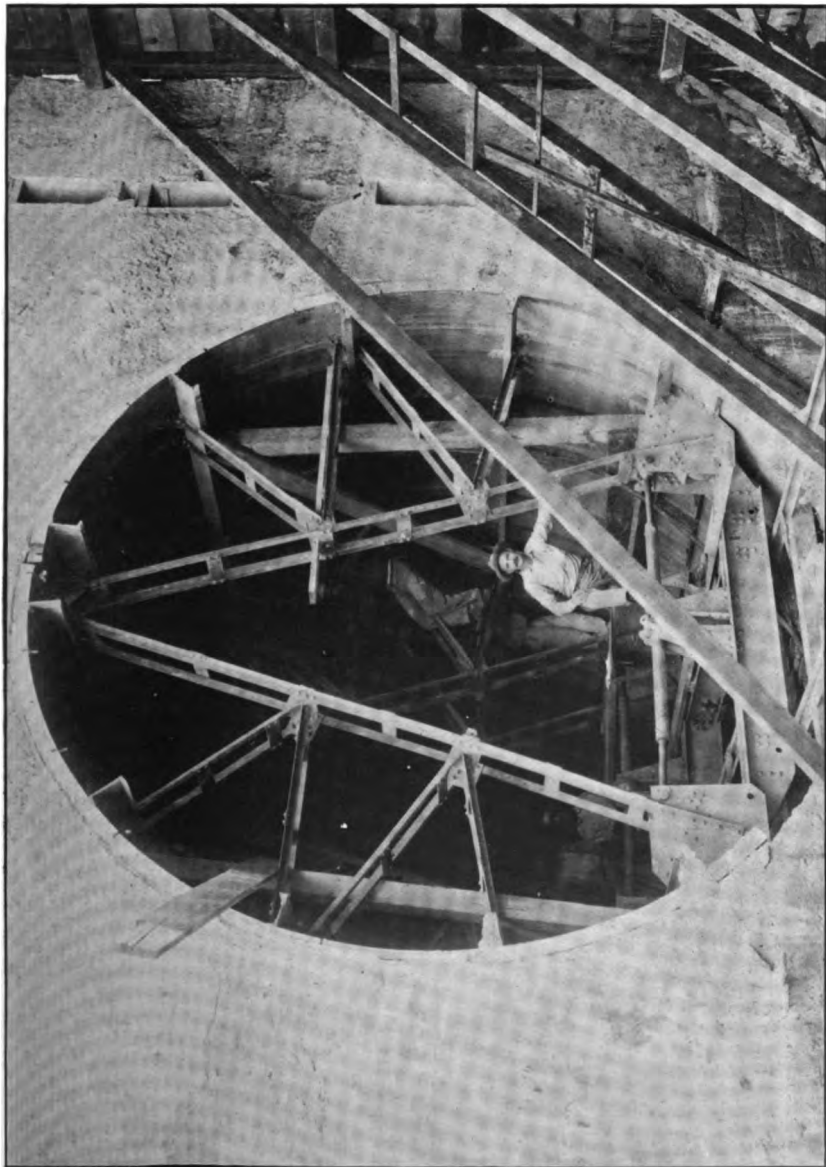




GATUN LOCKS LOOKING SOUTH, SHOWING LOWER LOCK IN PROCESS OF CONSTRUCTION WITH EAST AND WEST CHAMBERS OF MIDDLE AND UPPER LOCKS IN THE DISTANCE, JULY 27, 1911.

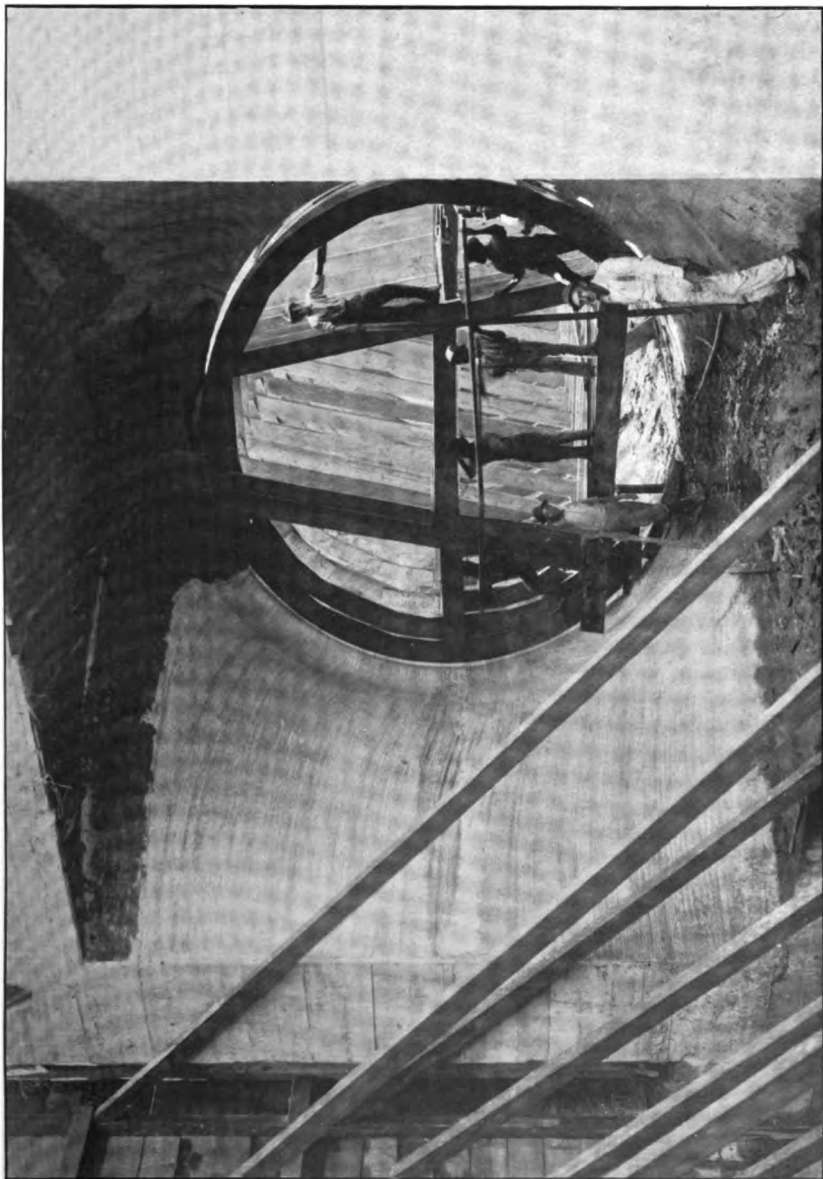






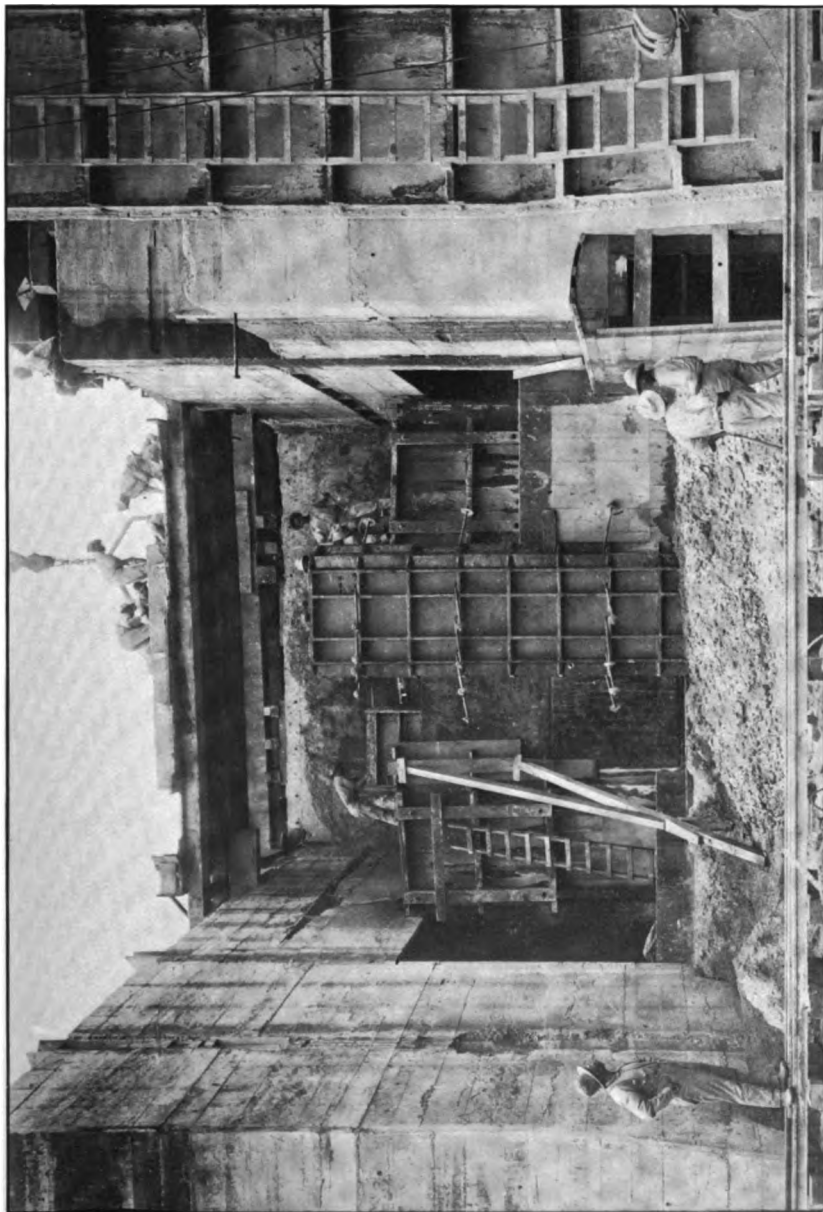
GATUN LOCKS SHOWING THE METHOD OF CONSTRUCTING 18-FOOT DIAMETER SIDE WALL CULVERTS WITH THE COLLAPSIBLE STEEL FORMS IN PLACE.





GATUN LOCKS, SHOWING THE CONSTRUCTION OF 18-FOOT CULVERT TRANSITION CURVE LEADING FROM A STONEY GATE CHAMBER.





GATUN LOCKS. ERECTING STONEY GATE VALVES IN THE EAST WALL OF THE LOWER LOCKS, JULY, 1911.

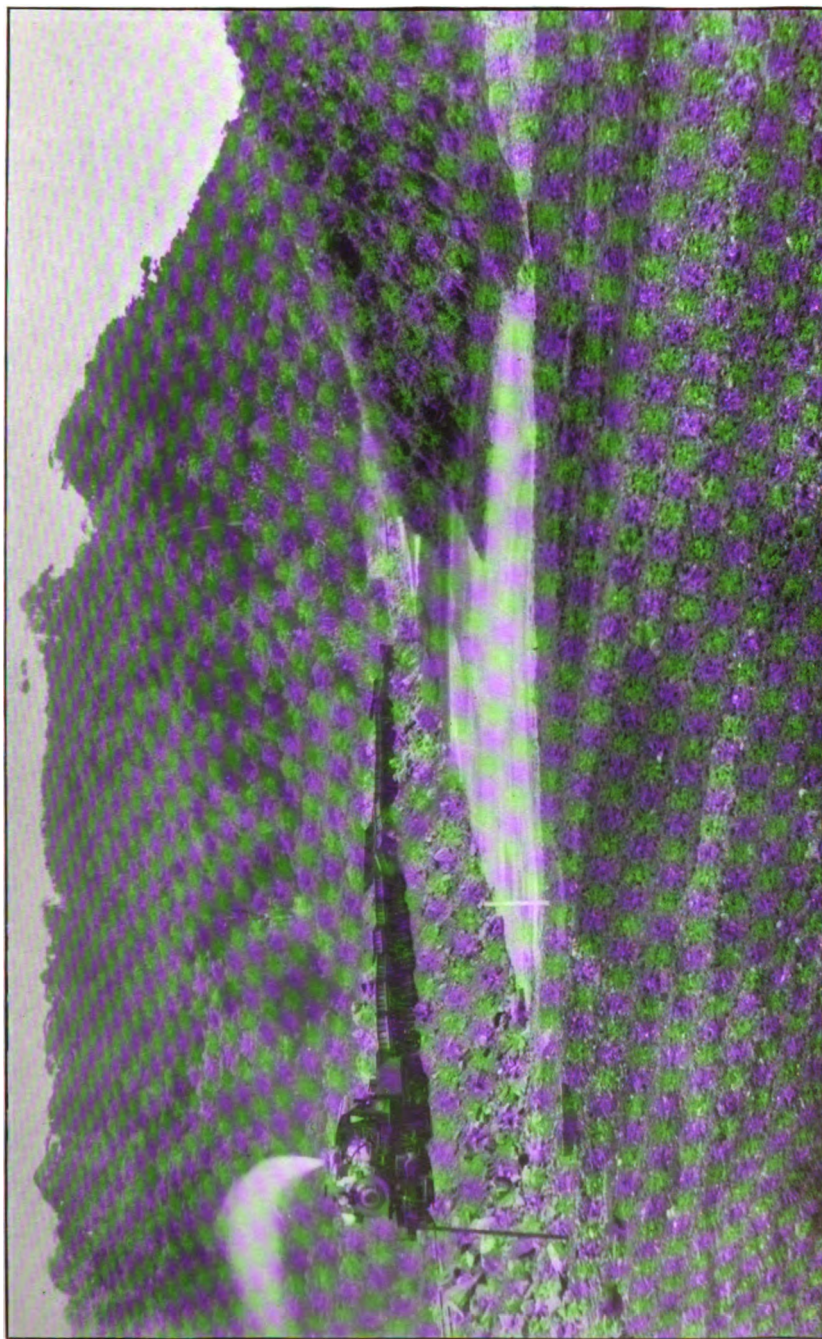




GATUN DAM LOOKING WEST TOWARD SPILLWAY WALL, SHOWING BAS OBISPO ROCK BEING DUMPED ON THE SOUTH FACE OF THE DAM, JULY, 1911.







GATUN DAM, SHOWING EXTREME WEST END OF DAM AND BLANKETING OF THE RIDGE, JULY, 1911.

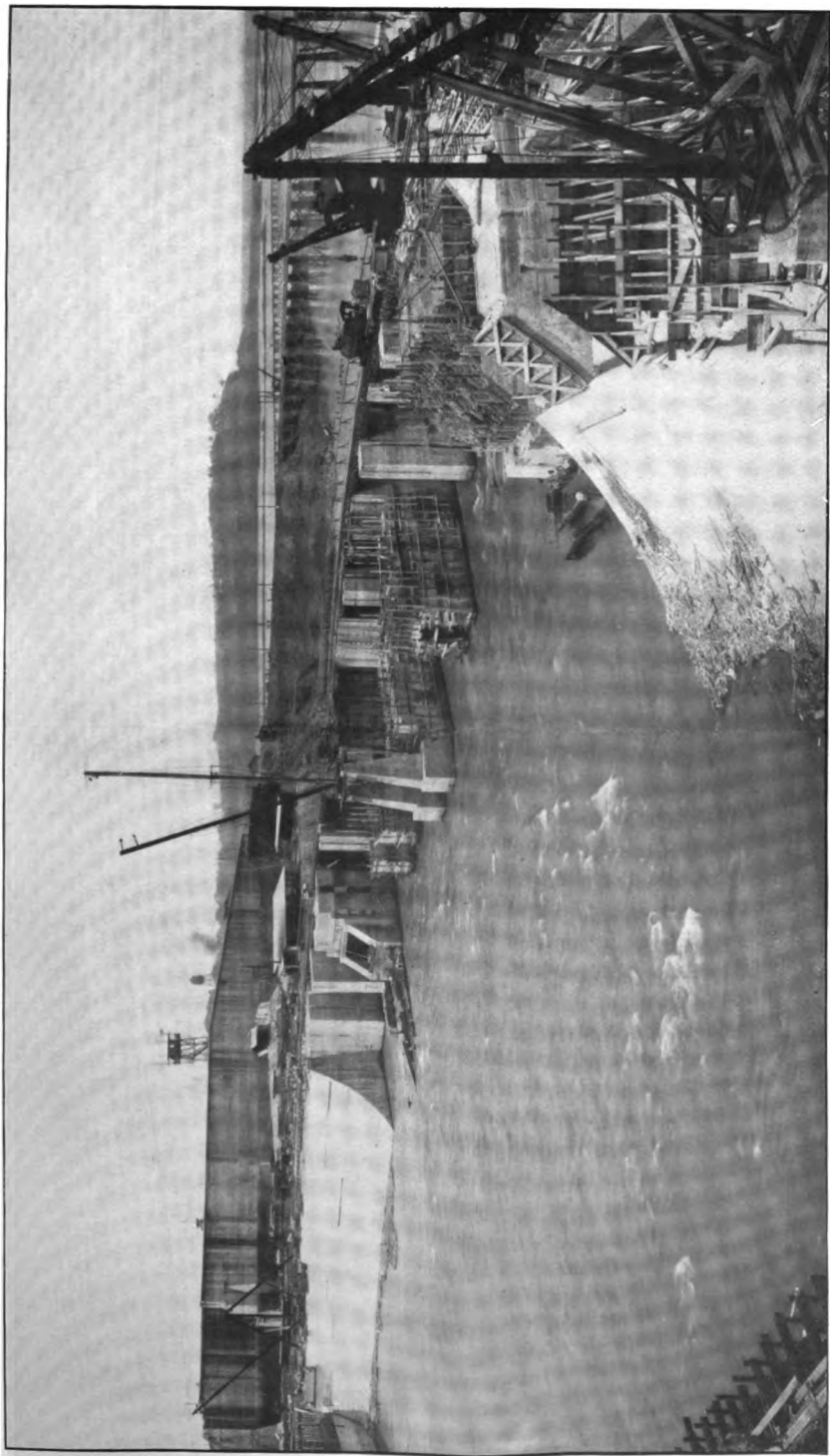


PLATE 21.



GATUN DAM LOOKING WEST TOWARD THE SPILLWAY WALL, SHOWING EAST SECTION OF THE DAM WITH HYDRAULIC FILL AT ELEVATION 73 FEET ABOVE SEA LEVEL, JULY, 1911.





GATUN DAM LOOKING SOUTHEAST, SHOWING PROGRESS OF CONSTRUCTION OF THE SPILLWAY DAM, JULY, 1911.

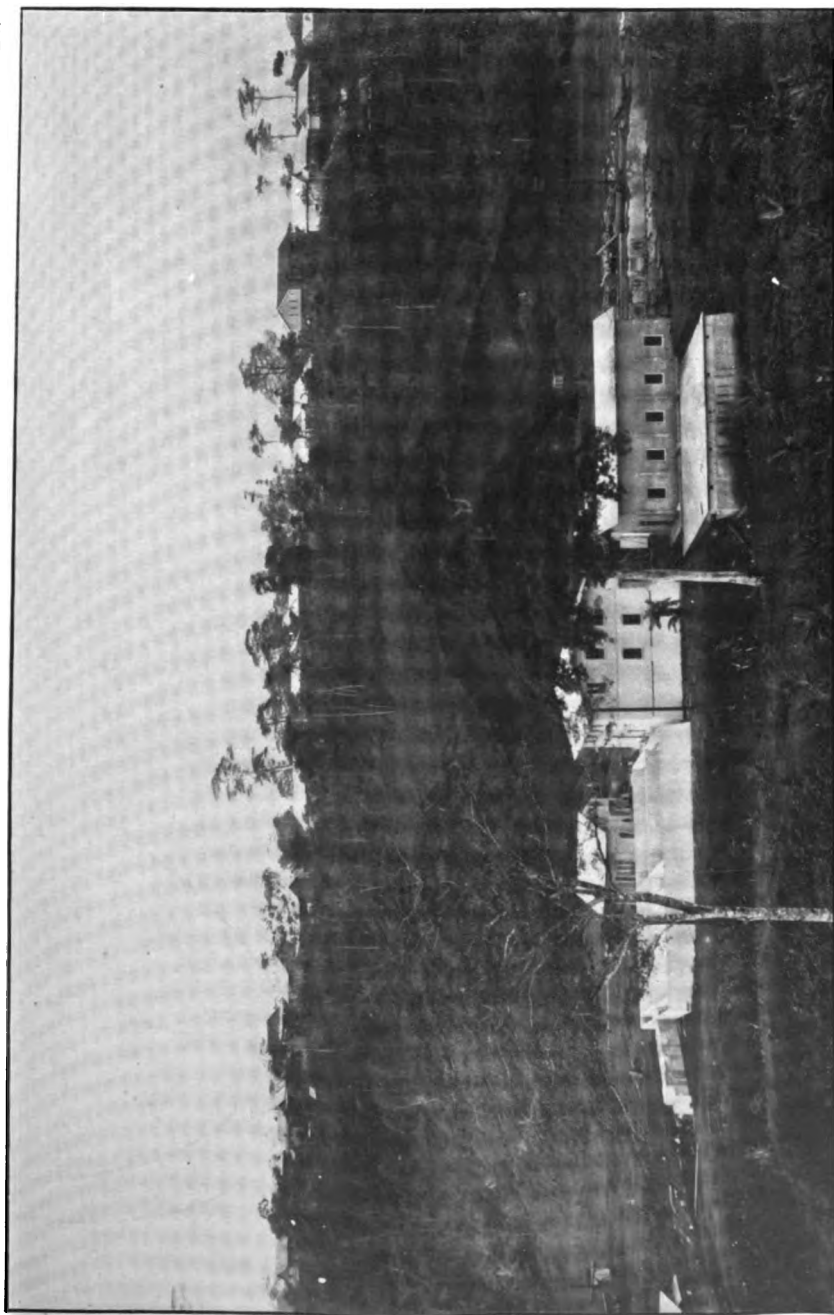




GATUN WATERWORKS, SHOWING THE AGUA CLARA RESERVOIR.

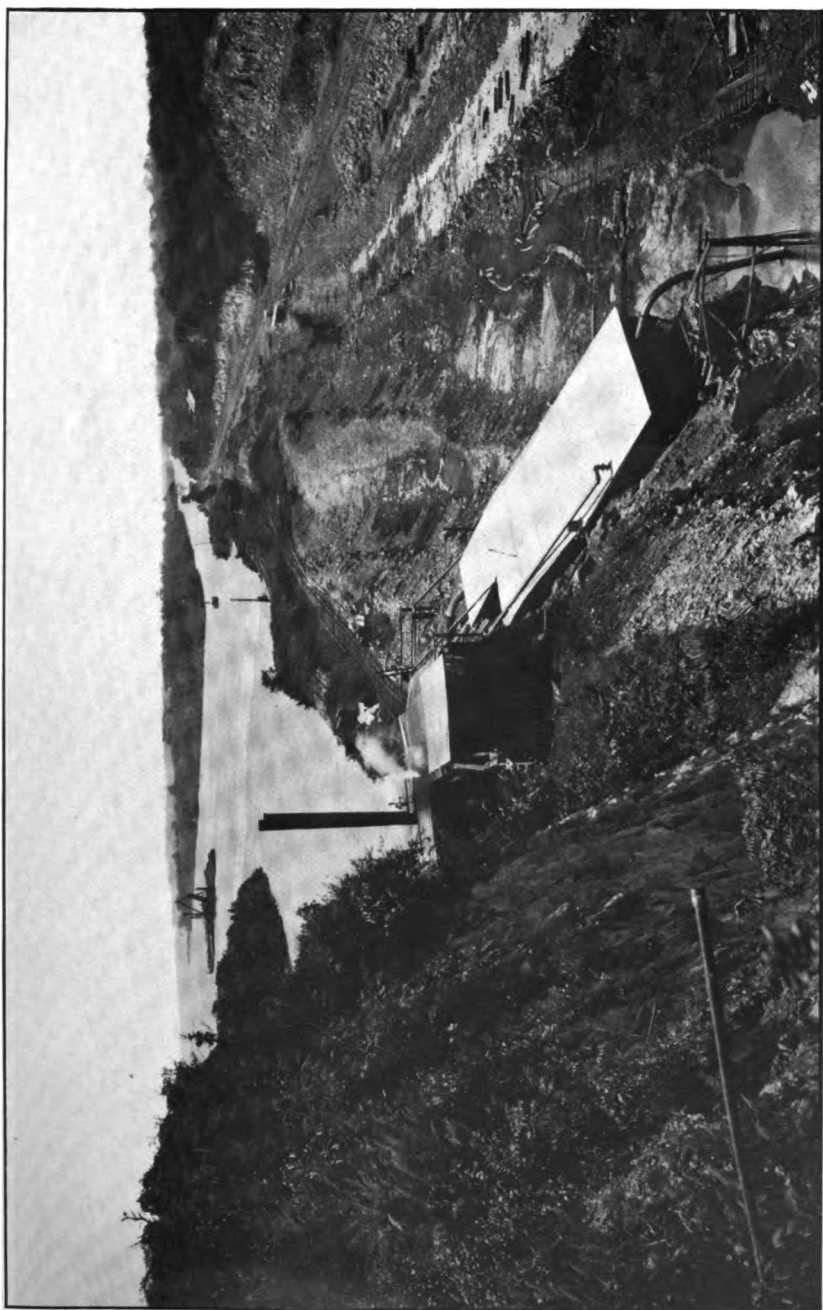






GATUN WATERWORKS, SHOWING PUMP STATION, FILTER BUILDING, SEDIMENTATION BASINS, AND CLEAR WATER BASIN, FORMING THE WATER PURIFICATION PLANT FOR GATUN.





MINDI EXCAVATION LOOKING NORTH FROM WEST BANK, SHOWING INTERSECTION OF AMERICAN AND FRENCH CANALS, JULY, 1911.





PORTO BELLO. WEST FACE OF QUARRY, LOOKING NORTH, JUNE, 1911.



## APPENDIX C.

### REPORT OF LIEUT. COL. D. D. GAILLARD, CORPS OF ENGINEERS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, DIVISION ENGINEER, CENTRAL DIVISION.

ISTHMIAN CANAL COMMISSION,  
OFFICE OF DIVISION ENGINEER, CENTRAL DIVISION,  
*Empire, Canal Zone, August 8, 1911.*

SIR: I have the honor to submit the following report of operations in the central division for the fiscal year ending June 30, 1911.

This report was prepared partly by myself and partly by Mr. A. S. Zinn, resident engineer, who was acting division engineer during my absence on leave, from May 18 to June 30, inclusive.

The central division extends from the south toe of Gatun Dam to the north end of the lock site at Pedro Miguel, a total distance along the axis of the canal of 31.69 miles, and embraces the entire extent of the former Culebra and Chagres divisions, which are now known as the Culebra and Chagres sections of the central division.

The total amount of material excavated in the above territory during the fiscal years ended June 30 from 1904 to 1911 is given in the following tables:

FROM CANAL PRISM.

	Earth.	Soft rock.	Hard rock.	Total.
<i>Fiscal year ending June 30—</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
1904.....	24, 024	30, 070	6, 013	60, 107
1905.....	397, 043	246, 998	97, 603	741, 644
1906.....	764, 327	489, 054	253, 181	1, 506, 562
1907.....	2, 288, 199	2, 449, 546	832, 687	5, 570, 432
1908.....	5, 078, 864	6, 508, 055	1, 872, 459	13, 459, 378
1909.....	6, 151, 152	9, 100, 862	3, 190, 620	18, 442, 634
1910.....	4, 570, 728	10, 578, 603	2, 656, 780	17, 806, 111
1911.....	4, 530, 568	11, 923, 880	2, 025, 194	18, 479, 642
<b>Total.....</b>	<b>23, 804, 905</b>	<b>41, 327, 058</b>	<b>10, 934, 537</b>	<b>76, 066, 500</b>

FROM OBISPO DIVERSION.

	Earth.	Rock.	Unclassified.	Total.
<i>Fiscal year ending June 30—</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
1907.....	128, 001	45, 221	.....	173, 222
1908.....	240, 063	73, 448	.....	313, 511
1909.....	293, 745	329, 535	.....	623, 280
1910.....	26, 066	.....	.....	26, 066
1911.....	25, 684	17, 366	.....	43, 050
<b>Total.....</b>	<b>713, 559</b>	<b>465, 570</b>	<b>.....</b>	<b>1, 179, 129</b>



## OUTSIDE WORK.

	Earth.	Rock.	Unclassified.	Total.
Fiscal year ending June 30—	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
1907.....	2,680	.....	21,680	24,360
1908.....	64,233	2,140	.....	66,373
1909.....	.....	1,873	.....	1,873
1910.....	33,631	.....	.....	33,631
1911.....	27,467	2,485	.....	29,952
Total.....	128,011	6,498	21,680	156,189

## TOTAL EXCAVATION, INCLUDING ACCESSORY WORK.

Fiscal year ending June 30—				
1904.....	24,024	36,083	.....	60,107
1905.....	397,043	344,601	.....	741,644
1906.....	764,327	742,235	.....	1,506,562
1907.....	2,418,880	3,327,454	21,680	5,768,014
1908.....	5,383,160	8,456,102	.....	13,839,262
1909.....	6,444,897	12,622,880	.....	19,067,777
1910.....	4,630,425	13,235,383	.....	17,865,808
1911.....	4,583,719	13,968,925	.....	18,552,644
Total.....	24,646,475	52,733,663	21,680	77,401,818

The amount of material removed during each month since the United States assumed control in May, 1904, is shown graphically on plate 104.

The following table shows the amount (place measurement) of material excavated monthly in the central division during the fiscal year ended June 30, 1911:

Months.	From canal prism.			Total, including accessory works.		
	Earth.	Rock.	Total.	Earth.	Rock.	Total.
1910.	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
July.....	288,913	1,031,003	1,319,916	295,521	1,032,048	1,328,109
August.....	430,117	1,177,621	1,607,738	434,775	1,177,621	1,612,396
September.....	459,473	1,114,765	1,574,238	459,473	1,114,765	1,574,238
October.....	515,045	1,076,678	1,591,723	525,577	1,076,678	1,602,255
November.....	417,359	1,053,077	1,470,436	417,359	1,053,077	1,470,436
December.....	399,883	1,008,998	1,408,881	399,883	1,008,998	1,408,881
1911.						
January.....	450,739	1,152,560	1,603,299	456,002	1,158,360	1,614,362
February.....	472,799	1,150,353	1,623,152	477,477	1,153,281	1,630,758
March.....	525,220	1,487,249	2,012,469	539,500	1,493,023	2,032,523
April.....	265,018	1,241,085	1,506,103	271,650	1,244,789	1,516,439
May.....	165,397	1,162,986	1,328,383	165,897	1,162,986	1,328,883
June.....	140,605	1,292,699	1,433,304	140,605	1,292,699	1,433,304
Total.....	4,530,568	13,949,074	18,479,642	4,583,719	13,968,925	18,552,644

In determining costs, the following yardage was used:

	Cubic yards.
From canal prism.....	18,413,085
From Obispo diversion.....	43,050
Silt deposit in prism.....	66,557
Total.....	18,522,692

In addition to the above yardage, 29,952 cubic yards of miscellaneous outside material were excavated for which no credit was given, making a grand total for the fiscal year of 18,552,644 cubic yards, as shown above.

The maximum monthly amount of material, including accessory work, excavated in the division during the fiscal year, aggregated 2,032,523 cubic yards removed in March, 1911. The maximum monthly amount of material excavated in the division since the inception of the work was 2,054,088 cubic yards removed in March, 1909. As stated in the last annual report, the output of March, 1909, will probably be the highest reached during the construction of the canal, on account of the decrease of available working space as the depth increases and the length of working territory decreases.

The maximum monthly amount of material from canal prism was excavated in March, 1911, amounting to 2,012,469 cubic yards, exceeding March, 1909, by 46,175 cubic yards. The maximum yearly amount of material from the canal prism was excavated in the fiscal year ending June 30, 1911, amounting to 18,479,642 cubic yards, exceeding the highest previous fiscal year (that of 1909) by 37,018 cubic yards. It is safe to say that the records of excavation from the canal prism, made in March, 1911, and the fiscal year ending June 30, 1911, will stand as the highest records reached during the construction of the canal.

Of the total amount of material excavated during the fiscal year 18,239,217 cubic yards were removed by steam shovels, 67,384 cubic yards by locomotive cranes equipped with clam-shell or orange-peel buckets, 14,494 cubic yards by hand, 19,072 cubic yards by scraper, 178,268 cubic yards by contractors, and 34,209 cubic yards blasted and washed away.

The material excavated by shovels is carried by dirt trains to dumps situated from 1 to 24 miles from the place of loading, the average haul being about 12 miles.

#### REVISED ESTIMATE OF THE QUANTITY OF MATERIAL YET TO BE REMOVED.

A revised estimate of the quantity of material to be excavated in the central division after June 30, 1911, in order to complete the canal, was submitted to the chairman and chief engineer and approved. This estimate gives an increase of 4,676,278 cubic yards over the estimate made on July 1, 1910. Details of the new estimate are given in the following table:

Locations.	Districts.				
	Chagres.	Empire.	Culebra.	Pedro Miguel.	Total.
Inside prism lines.....	<i>Cubic yards.</i> 442,921	<i>Cubic yards.</i> 5,565,886	<i>Cubic yards.</i> 11,224,449	<i>Cubic yards.</i> 904,733	<i>Cubic yards.</i> 18,138,089
Slides.....	.....	275,000	5,688,120	.....	5,963,120
Drainage cut.....	.....	89,000	181,852	.....	270,852
Sitting in Chagres River.....	91,000	.....	.....	.....	91,000
Total.....	533,921	5,929,886	17,004,421	904,733	24,463,061

The increase is mostly due to the unexpected development of slides beyond the limits assumed when making former estimates, especially in the two large slides at Culebra. Details of the new estimate for slides are given in the table following.

*Estimate of slides outside of slope lines for year ending July 1, 1911, showing total estimates of material to date.*

Locations.	Area of slide.	Material remaining.	Material excavated to date.	Excavated in year ending July 1, 1911.	Date when slide first developed.
	<i>Acres.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	
East side, opposite Bas Obispo.....	1.60	70,000	111,079	111,079	Sept., 1910
East side, opposite Haut Obispo.....	.60		18,064		Sept., 1908
West side, Buena Vista.....	.60	30,000	43,301	18,789	Nov., 1908
East side, Las Cascadas.....	8.30	30,000	500,640	290,166	Feb., 1908
East side, Whitehouse.....	4.60	40,000	286,000	134,000	Oct., 1908
Do.....	2.90		145,000	119,000	Oct., 1909
East side, Upper Lapita.....	1.70		19,988	13,128	Dec. 1909
East side, Lower Lapita.....	.30		30,120	30,120	May, 1910
West side, Cunette.....	.90	10,000	63,000	63,000	Sept., 1910
West side, Culebra.....	46.60	3,391,300	3,714,562	1,475,776	Oct., 1907
West side, North Contractor's Hill.....	2.60	182,470	240,300	90,688	Jan., 1907
East side, Culebra.....	31.60	1,664,350	2,329,784	1,454,081	Jan., 1908
East side, Cucaracha.....	47.10	400,000	2,722,164	716,746	July, 1905
West side, Contractor's Hill.....	2.00	20,000	211,036	146,228	July, 1908
East side, Paraiso.....	5.70	30,000	322,620	146,577	Mar., 1907
	157.10	5,868,120	10,757,658	4,879,378	

The above estimate shows that the total area covered by slides beyond original slope lines is 157.1 acres, and explains why previous estimates were too small. It is impossible to determine just how far back a slide will develop or what slope it will have when it reaches the angle of repose. The slides are discussed more in detail under the heading "Slides and breaks."

Although the estimated yardage remaining has been materially increased by the allowance for breaks, slides, and silting, yet it is believed that neither the ultimate time of completion of work in the central division, nor the ultimate cost as estimated in October, 1908, will be increased, as since that estimate was submitted the cost of excavation in the central division has decreased materially and the rate of progress has been greater than was then anticipated.

Up to and including June 30, 1911, 77,338,235 cubic yards, or 75.97 per cent of the total estimated excavation had been removed, leaving 24,463,061 cubic yards, or 24.03 per cent yet to be removed to complete all excavation within the limits of the central division. This excavation is divided as follows:

	Culebra section.		Chagres section.	
	<i>Cubic yards.</i>	<i>Per cent.</i>	<i>Cubic yards.</i>	<i>Per cent.</i>
Removed.....	65,514,865	73.25	11,823,370	95.68
Yet to be removed.....	23,929,140	26.75	533,921	4.32

#### BLASTING.

The total amount of material mined during the fiscal year was 11,672,241 cubic yards, which was 486,755 cubic yards less than in the previous year.

During the year 155 well or mechanical churn drills and 227 tripod drills were in operation, all of which were run by compressed air.

The number of linear feet of holes drilled during the year was as follows:

Kind of drilling.	Linear feet.	Miles.
Tripod drills.....	2,274,080	430.70
Well drills.....	2,217,982	420.07
Hand drills.....	308,347	58.40
Total.....	4,800,389	909.17

The quantity of explosives used during the year amounted to a total of 2,637.6 gross tons, which was 519.7 gross tons less than the amount used during the previous fiscal year. Of this amount 2,283,340 pounds were saltpeter dynamite of 60 per cent nitroglycerin and 3,624,992 pounds saltpeter dynamite of 45 per cent nitroglycerin. In using this dynamite the following blasting materials were used:

Detonators .....	248.801
Tape fuse .....	859,287 feet
Electric fuses:	
100-ampere .....	20
10-foot .....	500
18-foot .....	33,925
20-foot .....	57,350
24-foot .....	167,887
25-foot .....	21,930
30-foot .....	199,744
35-foot .....	136,270
40-foot .....	76,875
50-foot .....	32,700
Tape, insulated .....	7,081 rolls
Wire:	
Connecting .....	875 pounds
Lead .....	716,107 feet

Very stringent rules have been followed covering the handling, storage, and use of explosives. The distribution of explosives to the different parts of the work is under the direct charge of a supervisor, and the explosives are always handled by the same engine and train crew. All shooting is done by experienced blasting wiremen, using current direct from the electric-power station at Empire.

Owing to the great care taken in the handling of explosives, personal injuries have been nearly eliminated from this part of the work. During the fiscal year just passed, although over 5,900,000 pounds of dynamite were used, but two men were killed while handling dynamite.

#### STEAM SHOVELS.

The total number of steam shovels assigned to the central division at the close of the year was 52. These shovels were of the following sizes:

Class of shovel.	Capacity of dipper.	Number in service.
	<i>Cubic yards.</i>	
45-ton Bucyrus.....	1½	2
70-ton Bucyrus.....	3	9
95-ton Bucyrus.....	5	22
95-ton Bucyrus.....	4	10
Model 60, Marion.....	2½	1
Model 91, Marion.....	5	8

The number of cubic yards excavated by shovels, per hour, while under steam averaged 165.72 cubic yards for the present fiscal year, as compared with 155.80 cubic yards for the previous year, 150.46 for the fiscal year 1908-9, and 121.4 for the fiscal year 1907-8.

The highest daily, monthly, and annual records for shovels of each class are given in the table below:

	High daily record.			High monthly record.				High annual record.		
	Date.	Yardage.	Shovel number.	Date.	Yardage.	Shovel number.	Days worked.	Yardage.	Shovel number.	Days worked.
45-ton Bucyrus.....	Feb. 5, 1908	1,356	58	July, 1908	25,713	59	26	105,740	54	121
70-ton Bucyrus.....	May 7, 1908	2,630	128	Mar., 1909	53,043	122	27	300,872	122	254
95-ton Bucyrus.....	Mar. 22, 1910	4,465	213	Mar., 1910	70,290	213	26	543,481	208	295
Model 60, Marion.....	Apr. 18, 1908	1,704	152	Mar., 1908	41,219	152	26	.....	.....	.....
Model 91, Marion.....	Jan. 21, 1909	3,485	265	Aug. 1908	55,419	250	25	441,927	264	299

The following table shows the average performance of steam shovels for each month of the fiscal years ended June 30, 1908, 1909, 1910, and 1911:

Months.	Working days.	Output per shovel.				Rainfall at—		
		Per day.	Per month.	Per hour.		Bas Obispo.	Empire.	Culebra.
				Under steam.	At work.			
1907.		<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
July.....	26	683.1	17,670	89.5	167.8	8.25	9.89	9.31
August.....	27	719.5	19,428	93.6	164.6	12.69	11.24	11.81
September.....	24	818.2	19,636	105.9	174.7	14.71	10.86	11.38
October.....	27	791.9	21,385	100.5	186.8	13.62	15.44	15.27
November.....	24	773.3	18,562	89.9	170.6	9.85	10.40	6.91
December.....	25	922.3	23,057	120.7	192.2	2.26	1.47	2.30
1908.								
January.....	26	1,039.5	27,031	131.2	208.4	.20	.75	.91
February.....	24	1,112.1	26,690	142.2	215.6	.11	.00	.01
March.....	26	1,159.4	30,146	147.2	221.6	.41	.41	.13
April.....	25	1,191.1	29,780	152.9	230.6	1.81	1.36	1.67
May.....	25	905.7	22,618	115.2	201.4	13.18	12.91	12.43
June.....	26	1,011.2	26,294	130.6	210.5	6.55	8.21	8.86
Fiscal year 1908.....	305	931.9	23,685	121.4	199.1	83.64	82.94	80.99
1908.								
July.....	26	1,073.2	27,902	137.9	206.9	9.14	11.79	13.23
August.....	26	1,119.6	29,300	144.7	216.2	10.23	8.11	7.58
September.....	25	1,180.2	29,585	140.8	202.9	5.76	9.75	15.18
October.....	27	1,185.3	32,228	148.3	214.1	9.42	8.85	8.91
November.....	23	1,154.8	26,693	145.8	222.5	6.95	4.46	5.26
December.....	26	1,210.5	31,474	151.8	232.4	6.63	5.09	4.40
1909.								
January.....	25	1,183.0	29,575	148.3	225.8	2.59	2.28	2.06
February.....	23	1,260.4	29,342	157.7	246.8	4.72	1.50	2.46
March.....	27	1,327.2	35,835	167.5	258.5	.45	.21	.15
April.....	25	1,283.7	32,120	160.9	242.5	5.90	3.33	2.56
May.....	25	1,182.9	29,507	148.5	229.3	12.98	7.84	9.44
June.....	26	1,242.9	32,315	156.3	240.5	11.71	7.72	7.36
Fiscal year 1909.....	304	1,198.9	30,371	150.4	227.6	86.48	70.94	79.49

Months.	Work. ing days.	Output per shovel.				Rainfall at—		
		Per day.	Per month.	Per hour.		Bas Obispo.	Em- pire.	Cule- bra.
				Under steam.	At work.			
1909.								
July.....	26	<i>Cu. yds.</i> 1,206.9	<i>Cu. yds.</i> 31,379	<i>Cu. yds.</i> 152.1	238.8	11.59	8.27	7.95
August.....	26	1,132.8	29,668	142.0	218.9	7.03	7.20	8.32
September.....	25	1,248.3	31,208	156.3	239.8	7.90	7.22	8.40
October.....	26	1,230.1	32,079	154.1	237.0	16.98	21.13	17.70
November.....	24	1,161.3	27,875	147.8	223.9	28.41	21.08	24.46
December.....	26	1,114.6	28,982	141.9	224.9	12.33	9.44	10.58
1910.								
January.....	25	1,252.3	31,307	159.5	238.5	1.24	.70	1.31
February.....	23	1,272.8	29,274	161.6	224.1	1.80	.76	.93
March.....	26	1,388.0	36,060	176.8	260.2	3.12	1.60	1.36
April.....	26	1,295.2	33,074	163.8	291.5	3.85	4.24	5.35
May.....	25	1,263.8	31,596	172.3	276.8	11.09	11.08	10.50
June.....	26	1,229.2	31,962	156.2	238.2	12.08	10.17	11.16
Fiscal year 1910.....	304	1,231.0	31,185	155.8	236.1	117.42	102.89	108.02
1910.								
July.....	25	1,231.4	30,786	156.8	231.4	17.00	12.60	16.38
August.....	27	1,330.1	30,224	168.1	242.5	10.66	10.08	10.11
September.....	25	1,340.2	33,505	169.7	244.2	12.24	8.99	10.09
October.....	26	1,294.2	33,649	163.3	237.0	12.90	12.57	13.51
November.....	24	1,225.2	29,403	153.6	228.4	16.90	8.85	10.81
December.....	26	1,170.2	30,424	149.4	228.3	13.11	9.06	11.86
1911.								
January.....	25	1,330.0	33,251	167.7	236.7	.11	.02	.02
February.....	23	1,436.8	33,059	180.5	253.1	.71	.55	.74
March.....	27	1,434.6	36,743	181.0	258.5	.38	.20	.06
April.....	24	1,370.6	32,895	172.3	248.1	4.01	3.93	4.89
May.....	26	1,293.0	33,482	161.6	235.4	14.53	13.74	14.86
June.....	26	1,316.2	34,200	164.4	249.2	6.98	5.92	4.25
Fiscal year 1911.....	304	1,314.4	32,635	165.7	241.1	109.53	86.51	97.57

The number of cubic yards per hour under steam for the fiscal year ended June 30, 1908, averaged from 89.5 cubic yards to 152.9 cubic yards; during the year ended June 30, 1909, from 137.9 cubic yards to 167.5 cubic yards; during the fiscal year ended June 30, 1910, from 142 cubic yards to 176.8 cubic yards, while during the fiscal year ended June 30, 1911, the average ranged from 153.6 cubic yards to 181 cubic yards, a marked increase in the average efficiency of the operation of steam shovels during the four years in question. In comparing the average daily and monthly yardages shown in the tables above, it should be borne in mind that these averages are based on a day of 8 hours, while the working day in most other places where steam shovels are operated is 10 or more hours in length.

The average output per shovel per day within the limits of the central division for each month since the commencement of operations by the United States is shown graphically on Plate 105.

#### PLANT.

The motive power, rolling stock, and construction equipment of the central division in service on June 30, 1911, was as follows:

<b>Cars:</b>	
Decauville (Industrial).....	118
Dump, steel, Western—	
10-yard.....	209
17-yard.....	177

## Cars—Continued.

Dump, steel, Oliver—	
10-yard-----	245
17-yard-----	202
Dump, steel, Goodwin, 24-yard-----	12
Dump, steel, Ingoldsby, 31-yard-----	12
Flat, steel-----	45
Flat, Lidgerwood-----	1, 630
Motor-----	3
Pay-----	1
Locomotive cranes:	
15-ton-----	2
25-ton-----	4
100-ton-----	1
Locomotives:	
Decauville, 0-4-0 type-----	2
12 by 18, 0-4-2 type-----	1
15½ by 19½, 0-6-0 type-----	3
16 by 24, 4-4-0 type-----	2
16½ by 23½, 0-6-0 type-----	10
19 by 24, 2-6-0 type-----	104
20 by 26, 2-6-0 type-----	20
Pile drivers:	
Moonbeam-----	2
Swing circle-----	1
Plows, unloading:	
Right-----	17
Left-----	17
Steam shovels:	
45-ton Bucyrus-----	2
70-ton Bucyrus-----	9
95-ton Bucyrus-----	32
Model 60, Marion-----	1
Model 91, Marion-----	8
Spreaders:	
Jordan-----	1
Mann-McCann-----	11
Track shifters-----	4
Unloaders, 60-ton Lidgerwood-----	24

## TRANSPORTATION.

The average number of locomotives working per day and the total locomotive days during the year were as follows:

Class of work.	Average per day.	Total number days.
Handling spreaders.....	6.35	1,931
Handling unloaders.....	10.23	3,108
Handling track shifters.....	3.64	1,108
Handling dirt and miscellaneous trains.....	126.24	38,377
Average per day and total.....	146.46	44,524

The average number of cars loaded daily with excavated material, and the total number hauled during the year, was as follows:

Class of cars.	Average per day.	Total number handled.
Lidgerwood flats.....	2,266.34	689,578
Large steel dumps.....	324.92	98,771
Small steel dumps.....	1,146.71	348,602
Average per day and total.....	3,739.97	1,136,951

The largest number of cars handled in one day during the year was on March 11, 1911, when the following number were handled:

Lidgerwood flats.....	2,569
Large steel dumps.....	446
Small steel dumps.....	2,166
Total.....	5,181

## TRACKS.

The amount of trackage in the central division was increased by 8.91 miles during the year, making a total trackage in this division on June 30, 1911, of 209.16 miles. This statement, however, gives a very vague idea of the amount of track laid and taken up during the year in order to provide running tracks and loading tracks for the steam shovels in the cut. To do this, approximately 152.9 miles of track were removed, 215.08 miles of track laid, about 20 miles of track renewed, and 1,534.6 miles of track shifted. In addition, 590 frogs and switches were removed and 1,169 switches and frogs laid during the fiscal year.

At the close of the fiscal year there were 74.27 miles of track in the Culebra Cut alone, or an average of over eight tracks throughout the entire length of 8.5 miles of the cut. The location and distribution of the track in the central division is given in the following table:

Name and location.	1908	1909	1910	1911
In canal prism, total.....	272,321	364,103	385,884	402,256
Caimito.....				3,840
Tabernilla to Chagrecito.....	27,835	27,835	6,529	
Barbacoas-Caimito Junction.....				10,870
Powder-house line, Santa Cruz.....		10,525	9,860	10,860
High line, Obispo diversion.....	26,421	25,860	29,472	31,442
Santa Cruz, gravel.....				2,480
Bas Obispo.....	4,560	6,833	13,914	
Old Gamboa and Las Cascadas.....	3,376	2,890		
Tabernilla yard.....				7,250
Cucaracha.....	6,400	4,145		
Paraiso.....	22,430	14,140	22,150	19,565
Old Panama R. R., Paraiso to Corozal.....				46,214
Pedro Miguel.....	61,944	60,244	46,980	52,537
Miraflores third track.....	3,005	3,005	3,005	3,005
Corozal yard and third track.....	5,500			
East Mamel.....			2,750	
Gamboa yard.....				11,700
Total east of canal.....	161,471	155,478	134,660	199,793
Gorgona.....			1,800	
Caimito.....	2,065	8,135		
Juan Grande.....	5,313		10,201	
Alligator curve.....	9,011	9,011	6,700	
Gorgona yard.....	31,958	37,172	37,172	9,700
Matachin.....	1,240	4,160	9,219	8,800
Bas Obispo.....	10,066	10,460	4,670	2,230
Las Cascadas and Bridge 52.....	21,775	13,310	22,300	23,300
Whitehouse.....	21,780	16,130	18,400	19,511
High line, Whitehouse to Lirio.....	11,940	7,073	7,275	
Whitehouse and Empire yard.....				5,960
Cunette.....	4,495	3,220	3,118	
Empire yard.....	39,431	46,213	44,518	33,923
Lirio.....	23,530	26,694	26,100	22,325
Culebra.....	15,554	8,415	11,083	8,220
Rio Grande.....	16,504	17,123	16,855	17,426
Cucaracha.....	17,278	8,060	5,850	3,800
Paraiso.....			5,346	5,346
Total west of canal.....	231,940	210,178	229,805	160,530



Name and location.	1908	1909	1910	1911
Tabernilla prism dumps.....			3,225	
Tabernilla.....	62,640	80,196	82,895	55,400
San Pablo.....	5,120	9,475	1,120	1,120
Calmito.....	9,055	10,540	985	
Mamel.....	3,421	3,481	5,300	
New Panama R. R., north of Juan Grande.....		2,094	8,028	1 29,580
Gorgona.....	10,429	9,500	10,560	9,600
Gorgona River dumps.....				2,700
New Panama R. R., south of Juan Grande.....		16,347	45,866	1 88,700
Point No. 3.....		2,915	13,500	
Matachin:				
East of canal.....		3,154		
West of canal.....	3,532	10,259	1,068	
Santa Cruz:				
East of canal.....	2,720	10,978	2,850	
West of canal.....	5,224	5,224		
Lirio.....	8,625	10,115	3,725	
Gold Hill.....	20,094	18,895	11,730	13,450
Cardenas River (Miraflores).....	37,200	37,989	39,343	40,800
Bosa-Corozal Dam.....	14,520			
Balboa (La Boca) Y and dumps.....	49,151	65,035	76,800	93,230
Culebra.....				7,174
Total dump tracks.....	231,531	296,196	306,995	341,814
Total track used by central division, exclusive of Panama R. R. main line.....	897,263	1,026,017	1,057,344	1,104,393
Total track, in miles.....	109.94	194.32	200.25	209.16

1 24,740 feet of this track owned by Panama R. R., but used and maintained by central division.

NOTE.—Of the 109.94 miles shown in 1908, 151.57 miles were on the old Culebra division and 18.37 miles were on the old Chagres division.

#### DUMPS.

During the year, 18,151,722 cubic yards of material were deposited in the various dumps named in the accompanying table:

Name of dump.	Wasted prior to July 1, 1910.	Wasted during fiscal year 1910-11.	Total wasted.	Remaining capacity.
Gatun.....	1,558,678	2,230,438	3,789,116	1,799,560
Chagresito.....	98,463	49,255	147,718	
Tabernilla.....	15,080,749	1,008,098	16,088,847	7,098,000
Calmito.....	1,480,702	220,712	1,701,414	
Calmito-Gamboia (P. R. R. relocation).....	3,654,120	3,471,562	7,125,682	
Mamel.....	780,860	186,427	967,287	813,000
Juan Grande.....	886,721	388,921	1,275,642	
Gorgona.....	729,357	49,255	778,612	281,000
Obispo diversion.....	1,070,895	25,171	1,096,066	20,000
Gold Hill.....	885,533	91,678	977,211	1,600,000
Paraiso-Corozal (P. R. R. relocation).....	825,541	37,659	863,200	
Miraflores.....	6,963,135	3,478,706	10,441,841	4,521,000
Balboa.....	9,214,976	4,646,841	13,861,817	23,700,000
Naos Island trestle.....	182,239	208,608	390,847	700,000
Miscellaneous.....	3,123,084	51,892	3,174,976	
Dumped prior to July 1, 1910, on dumps not used this year.....	11,426,391		11,426,391	
East relocation.....	854,099	929,065	1,783,164	6,000,000
East Mamel.....		180,432	180,432	
Culebra Swamp.....		243,132	243,132	600,000
Point 4.....		611,240	611,240	
Pacific division miscellaneous.....		42,600	42,600	
Total.....	58,815,543	18,151,722	76,967,265	47,000,560

The number of dumps has necessarily decreased as the depth of the canal has increased, as it is impossible to haul loaded trains out of the canal except at either end of the Culebra Cut. Trains are run from the south end of the cut at Pedro Miguel to dumps at Balboa and Miraflores, and from the north end of the cut to the

Gatun Dam and over the Gamboa Bridge to dumps on the Panama Railroad relocation. Several new dumps of limited capacity were opened up in the Chagres section to take care of local excavation. The Tabernilla dumps were not used after December 12, 1910.

The average amount of material dumped per day at the larger dumps was as follows:

	Cubic yards.
Tabernilla.....	3,316
Miraflores.....	11,443
Balboa.....	15,286
Gamboa to Calmito (relocation).....	14,476

The material deposited at Balboa is serving a very useful purpose in reclaiming from the ocean land which in time will be very valuable. Prior to June 30, 1910, 253 acres of land in this locality had been filled in and during the fiscal year ended June 30, 1911, 62 acres have been reclaimed, making a total of 315 acres. The material deposited at Tabernilla and Miraflores is wasted.

The material dumped on the Panama Railroad relocation prior to June 30, 1910, was used for filling the trestles and for raising the embankment to the desired level. Since then most of it has been wasted. Three million five hundred and nine thousand two hundred and twenty-one cubic yards of material from the central division were dumped on the Panama Railroad relocation during the fiscal year ended June 30, 1911, making a total of 7,988,882 cubic yards in all furnished to that date by the central division.

In compliance with instructions of March 20, 1908, from the chairman and chief engineer, the central division continued to furnish hard rock for use in constructing the toes of the Gatun Dam. The total amount of material delivered at Gatun during the fiscal year was 2,230,438 cubic yards, making a total of 3,789,116 cubic yards in all. The daily average number of trains from the Culebra Cut to Gatun was 19.72, and the highest number hauled in one day was 25 on March 20, 1911. The average haul to Gatun is 28.5 miles, or 57 miles for the round trip.

The following table shows the amount of trestle driven in the central division in connection with dumping operations during the fiscal years 1909, 1910, and 1911:

Name and location.	1909	1910	1911
Balboa (La Boca) dumps.....	6,539	4,074	6,273
Culebra dumps.....			920
Cardenas River dumps (Miraflores).....	1,742		
Haut Obispo to Bas Obispo.....	395		
Bas Obispo.....	1,256		
Near Bridge 52.....	178		
Canal connection, Matachin.....	780		
Santa Cruz.....	1,330		
Powder-house line, Santa Cruz.....	1,361		
Matachin to Santa Cruz.....	136		
Point No. 3.....	439		
Gorgona dump.....	15		448
Relocation dumps.....		4,045	4,749
Calmito to Tabernilla.....	505	110	868
Tabernilla dumps.....	897		679
Trestles in cut.....		169	
Obispo diversion.....	1,923	456	462
Miscellaneous.....	1,131		290
Redriven and repaired.....	882	2,260	
Total feet.....	19,509	11,114	14,659
Total miles.....	3.09	2.10	2.78

As the material excavated in the Chagres section of the central division during the fiscal year was composed almost wholly of clay and silt, this material became very soft when exposed to the constant downpours during the rainy season, and in some localities it was found absolutely impossible, at any reasonable expense, to maintain a dump composed of such material at the necessary height of from 15 to 20 feet while the rains lasted. It therefore became necessary to devise some method whereby saturated earth and clay could be readily and economically dumped from the equipment used on this section of the work, i. e., steel dump cars of 10 cubic yards capacity. Two methods of accomplishing the desired result proved quite successful, both as regards facility for dumping and cost of same. One of the dumps was located on firm material near the west bank of the Chagres River at Juan Grande. The material to be disposed of was dumped on the bank between the dump track and the river.

A 4-inch water pipe, provided with several outlets, was laid alongside this track, and by means of it the material as soon as dumped was thoroughly wetted by a dumping gang of from 5 to 12 men. When well saturated this material would slide slowly and fairly uniformly into the Chagres River, the swift current of which in time carried the greater part of it away. The operation of wetting the dumped material was facilitated by a spreader, which when the material formed in a ridge on the river side of the track, would level it so that its top surface was about 1 foot below the rail, forming a wide, shallow depression, in which the water from the pipe outlets was allowed to run and form shallow pools until absorbed by the dumped material. The use of the spreader also facilitated the sliding of the saturated mass into the river.

By the method just described the well-known tendency of all saturated clays on the Isthmus to develop slides was utilized to form an artificial slide which would aid in disposing of dumped material and would prove beneficial instead of harmful, as in the case of slides in the banks of the canal.

Three hundred and eighty-nine thousand cubic yards of material, principally clay, were disposed of on the artificial slide dump at Juan Grande, just described, and when operations ceased the upper surface of the dump had a slope of 1 vertical to 22 horizontal for the distance of 345 feet between the dump track and the west bank of the Chagres River. This extremely flat slope indicates very clearly the facility with which Isthmian clays move laterally, forming slides when saturated and resting on a sloping surface.

On this dump a train of 12 steel dump cars containing 10 cubic yards each was on many occasions dumped by a trained dumping gang in from 20 to 30 seconds from the time the train stopped on the dump until it was again in motion leaving same. As much as 5,000 cubic yards per day of nine hours has been disposed of on this dump, which had a total length parallel to the axis of the river of but about 400 feet.

The second method of disposing of similar material was tried between Point 4 and Point 4-B where a low trestle was driven across the Chagres River at the beginning of the dry season, at a locality where the current of the river was very swift. The material dumped at this place was in every respect similar to that described in what precedes and the cars were of the same type.

The material was dumped into the river, the current of which washed it away and carried it downstream. At times, when a large amount of material was being dumped from this trestle, which was only about 250 feet in length, a dam would be formed which would raise the water on the upstream side from 1 to 3 feet higher than that on the downstream side of the trestle, developing a head which would quickly cause the water to break through the dumped material and would increase the velocity of the current to such an extent that the adjacent material was promptly carried downstream. In all, 214,000 cubic yards of material, mostly clay, were disposed of on this dump.

On one occasion the division engineer for one hour noted the time occupied in dumping trains of eight cars containing 10 cubic yards of material each, and it was found that the total time consumed per train varied from 30 seconds to 1 minute, the time being computed from the moment the train came to a stop on the trestle until it again started for the work, the dumping having been completed.

The reason that a little more time was consumed in dumping here than at the sliding dump at Juan Grande was because the men who dumped the cars could not get as secure footing on the trestle as they could on the bank at Juan Grande; otherwise there was no reason why the time of dumping should not have been practically the same at the two places. The accompanying photographs show the two dumps just described. (Pls. 32 and 33. See also Pl. 106.)

During the fiscal year work was in progress at a number of different places in the central division, and the names of the localities and amount of work accomplished at each place during the fiscal year, together with the amount yet to be done, are given in what follows.

#### DIVERSIONS.

A description giving the locations and showing the necessity of the three diversions was given in last year's annual report on pages 147 and 148. In that report reference was made to the break at La Pita Point on May 7, 1910, when the water from the Obispo diversion flowed into the canal for three days. A temporary wooden flume was quickly constructed to take care of the water from ordinary rainfall. On December 3, 1910, an unusually heavy rain caused the water to flow over the dirt embankment at the end of the wing wall and break through into the canal. Repairs were made in one day, and the wooden flume carried the water up to January 9, 1911, when work on a permanent reinforced concrete flume 7 feet high, 22 feet 6 inches wide, and 400 feet long was commenced, and completed April 26, 1911. It contains 1,020 cubic yards of concrete (hand mixed) and cost \$6,224.44. The gravel and sand used in this flume were taken from Points 1 and 2 by orange-peel dredges. The maximum discharge capacity is 3,040 cubic feet per second, which is 15 per cent more than the greatest recorded flow of water at that point. It is believed no more trouble at that point will be experienced.

Early in October, 1910, the White House slide, near the Sardanilla River, broke back to the Obispo diversion dike. For fear the diversion might break through the dike in case the slide developed more, plans were immediately made and approved for carrying the diversion about 1,000 feet farther from the canal at that point, by making

a cut through a saddle connecting two ravines. This work required the excavation of 22,416 cubic yards and was completed during the dry season of 1911. Some of the work was done by hand by shoveling the dirt into Decauville cars and hauling it away, and the balance was performed by mule teams and scrapers, all under the supervision of a foreman employed by the commission.

#### CULEBRA SECTION.

This section extends from Gamboa to Pedro Miguel and is usually known as the Culebra cut. The time of completion of excavation within the limits of the central division will be fixed by the time necessary to complete the Culebra section; consequently, all efforts are concentrated on this particular part of the work. Previous to June 30, 1910, 49,293,193 cubic yards had been excavated in the Culebra section. During the fiscal year ending June 30, 1911, 16,221,672 cubic yards were excavated, leaving 23,929,140 cubic yards yet to be excavated in order to complete this section of the canal. A number of new slides have developed, and in addition in places along the deeper parts of the cut, where the rock is unusually soft, and especially where there are numerous faults and seams, portions of the bank have broken away and settled down into the canal, thus necessitating the removal of a considerable amount of material lying wholly outside the slope lines of the canal. The amount removed and to be removed from these slides is shown on slide estimate, page 136.

Below Gamboa the Chagres River is a winding stream and crosses the axis of the canal twenty-three times before it reaches Gatun, forming a series of peninsulas, which, commencing at Gamboa, are known as Point 1, Point 2, Point 3, etc. The last annual report gives the location of points and the dates when work commenced at Points 1 to 6, inclusive, the amount of material removed prior to July 1, 1910, and the amount remaining at that time.

#### POINT 1.

Most of the material remaining July 1, 1911 (90,000 cubic yards), at this point was gravel and sand washed in by the Chagres River. The amount of gravel and sand removed during the fiscal year ending June 30, 1911, was 20,455 cubic yards. Future gravel deposits will be removed and the gravel used for track ballast and concrete. Silt deposits will be removed by means of suction dredges when Lake Gatun has been flooded.

#### POINT 2.

In the fiscal year ending June 30, 1911, 46,102 cubic yards of gravel and sand were removed from Point 2, and there remained July 1, 1911, 5,000 cubic yards of silt, sand, and gravel.

#### POINT 3.

The amount of material remaining at this point on June 30, 1910, was 157,522 cubic yards, and the amount remaining June 30, 1911, was 50,000 cubic yards. As only 16,254 cubic yards were excavated during the year, this shows that 91,268 cubic yards were washed away during the fiscal year, making 107,522 cubic yards disposed of at this point.

## POINT 4.

Eight hundred and twenty-eight thousand four hundred and sixty-two cubic yards of material were removed from this point during the fiscal year ending June 30, 1911, and there remained to be removed on July 1, 1911, 1,000 cubic yards. The work at this point was completed in May, 1911, so far as will be done by dry excavation.

## POINT 5 (JUAN GRANDE).

Four hundred and thirty-eight thousand two hundred and forty-one cubic yards of material were removed at Juan Grande by steam shovels during the fiscal year ending June 30, 1911. Work at this point was completed on April 15, 1911.

## POINT 6.

One hundred and twelve thousand two hundred and thirty-eight cubic yards of material were removed at Point 6 by steam shovels during the fiscal year ending June 30, 1911. Work at this point was completed in October, 1910.

## EAST MAMEI.

Five hundred and ninety-eight thousand two hundred and thirteen cubic yards of material were removed from East Mamei by steam shovels during the fiscal year ending June 30, 1911. The work at this point was completed in March, 1911.

## MAMEI.

Ten thousand and eighty-six cubic yards were removed from Mamei by steam shovels in July, 1910. Work was completed on July 21, 1910.

## SAN PABLO.

No material was removed from San Pablo during the fiscal year ending June 30, 1911. This excavation will be completed during the dry season of 1912. The number of cubic yards remaining to complete the excavation at this point is estimated at 257,959 cubic yards, which will be removed by steam shovels.

## CAIMITO.

Seven hundred and thirty-one cubic yards were removed from Caimito by steam shovels in March, 1911, completing the work at this point.

## TABERNILLA.

Fifty-one thousand, nine hundred and seventy cubic yards of material were removed in February and March, 1911, 50,917 cubic yards of which were removed by steam shovels, and the balance by hand and orange-peel cranes. There remains to be removed 15,100

cubic yards. This material is under the tracks of the Panama Railroad, and will be taken out next dry season as soon as the tracks are abandoned.

#### HAND WORK BY CONTRACT.

A contract was entered into with Messrs. Hebard & Alberts on November 22, 1909, to excavate 170,808 cubic yards from the canal prism between San Pablo and Bohio, at a cost of 35 cents per cubic yard. Work was begun by the contractors December 1, 1909, and by the close of the fiscal year 156,976 cubic yards had been excavated by them. During the present fiscal year 13,832 cubic yards were excavated, which completed their contract.

Another contract was entered into with Mr. Earl C. McFarland on March 21, 1910, to excavate about 202,140 cubic yards from the canal prism between Tabernilla and Bohio, at a cost of 21 cents per cubic yard for earth, 25 cents per cubic yard for soft rock, and 30 cents per cubic yard for hard rock. Work was begun by the contractor in October, 1910, and by the close of the fiscal year 105,532 cubic yards had been excavated by him, leaving 96,608 cubic yards still to be excavated. On May 26, 1911, an agreement was entered into with Mr. E. C. McFarland, supplementary to the agreement of March 21, 1910, establishing a price of 34 cents per cubic yard for all earth, soft and hard rock remaining to be excavated after April 25, 1911.

Another contract was entered into with Mr. Llewellyn Swain on December 6, 1910, to excavate about 112,450 cubic yards from the canal prism between stations 28-1000 and 28-2300 at a point commonly known as 4-B, at a cost of  $21\frac{1}{2}$  cents per cubic yard. Work was begun by the contractor in December, 1910, and by the close of the fiscal year 58,904 cubic yards had been excavated by him, leaving 53,546 cubic yards still to be excavated.

#### CUTTING TIMBER AND BRUSH FROM THE CHANNEL IN LAKE GATUN.

The work of clearing, grubbing, and burning trees in the channel of Lake Gatun by employees of the central division was commenced at the beginning of the dry season, and 182 acres of trees and brush were cut in the vicinity of Chagrecito and Bohio, at a cost of \$24.50 per acre. This completed all clearing in the channel throughout the central division.

#### LIGHTING AND BUOYING WORK.

The work of running profiles and clearing for lighting and buoying work was begun in May, 1911, and up to June 30, 1911, 16,200 feet of profile had been run, which made it necessary to cut 67,550 feet of trocha. The cost of running this profile and cutting trocha was 10.16 cents per foot of profile run. In connection with this work, it was also necessary to clear 373.5 acres, at a cost of \$28.36 per acre.

#### NAOS ISLAND DIKE.

In order to construct the dike from East Balboa to Naos Island a pile trestle was driven from the shore toward the island, which is

situated in Panama Bay a little over 3 miles from the mainland. From this trestle material from the Culebra cut is dumped, and when the trestle is completely filled tracks are thrown and the dike widened and used as a dump.

Previous to June 30, 1910, the trestle had been constructed for a distance of 2.4 miles. During the fiscal year ending June 30, 1911, this trestle was extended 2,006 feet, giving a total length of trestle from the shore line of 2.78 miles. The end of the trestle on June 30, 1911, was 2,737 feet from Naos Island and the filling extended to within 1,500 feet of the end of the trestle.

Much trouble has been experienced during the past year in extending the outer end of the dike owing to the sliding of the bottom, due to the weight of the stone filling dumped from the trestle. This sliding has been encountered at every foot of the last 4,000 feet of the dike and results in continual settlement of the roadbed for the first two or three months, when it gradually diminishes and finally ceases.

Formerly the tidal currents crossed the channel in Panama Bay from east to west, depositing in it a large amount of sediment. The work so far accomplished in the construction of this dike has been of material benefit, not only in decreasing the deposit of sediment, but also in protecting vessels from the currents which at times render it somewhat difficult for them to navigate the channel. When this dike has been completed the entire artificial channel in its vicinity will be protected from currents and abnormal deposits of silt. Plans have been made for pushing this work more rapidly in order to complete the filling before the material from Culebra cut becomes exhausted.

#### SLIDES AND BREAKS.

Ever since the Americans started work, the progress of the excavation of Culebra Cut has been slow and difficult at times on account of slides and breaks on the side slopes. The trouble gradually increased as the cut deepened. It has been impossible to determine to what extent the slides and breaks would develop, and for that reason, it has not been practicable to carry out any predetermined plans as to arrangement of tracks and the placing of steam shovels. It is the consensus of opinion, however, that the only solution of the problem is to excavate and haul away the material until the slide comes to rest by the material reaching the angle of repose. This has been done with six good-sized slides which are now "dead," and it is safe to assume that it will be the experience with the remaining slides.

A number of these slides have been described in former annual reports. The last annual report mentioned Cucaracha slide as the most important, and the Culebra slide on the west bank of the canal as the next largest. Cucaracha slide then covered 47.1 acres, and Culebra slide 7.3 acres. Since that time, Culebra slide has developed considerably and has given a great deal of trouble and now covers 46.6 acres.

It will be seen from slide estimate on page 136 that up to July 1, 1911, 2,722,164 cubic yards of material had been removed from Cucaracha slide and there remained 400,000 cubic yards, or a total of 3,122,164 cubic yards; that 3,714,562 cubic yards had been removed from the Culebra slide and that there remained 3,391,300 cubic yards,



or a total of 7,105,862 cubic yards, or over twice the amount in the Cucaracha slide.

The last shovel cut at the foot of Cucaracha slide was made during the first part of June, 1911, on the proposed permanent berm at the 95-foot level, and since then there has been no sign of any more movement, so the Cucaracha slide appears to be practically "dead," and little more trouble is anticipated from it. (See Pl. 107.)

The next largest slide is that on the east bank, opposite Culebra. The estimate shows that up to July 1, 1911, 2,329,784 cubic yards had been removed and there remained 1,664,350 cubic yards, or a total of 3,994,134 cubic yards.

By direction of the chairman and chief engineer, excavation work was started during the first part of the dry season of 1911 at the top of Culebra slide on the west bank. By the middle of April, 1911, three shovels were working and they have been at work ever since and have accomplished excellent results. The removal of the heavy material from the top is already beginning to show good effects, as less trouble is now experienced by the heaving up of the bottom of the cut due to the excessive earth pressure from above.

The plan has worked so well that the chairman and chief engineer approved a similar plan for handling the material above the slide on the east bank of the canal at Culebra. At the end of the fiscal year ending June 30, 1911, the work had advanced far enough to allow three shovels to work there to advantage and it is believed that as soon as the heavy material from above is removed, the trouble with the heaving of the bottom of the cut will stop, as on the west side. As soon as this trouble at the bottom of the cut is under control, it will be easy to lower the cut at the center for drainage and push the work to rapid completion.

Some of the so-called "slides" are not strictly slides but are "breaks" resulting from the failure of a softer underlying layer of rock due to the pressure of the very heavy superincumbent mass. As the cut becomes deeper, the fairly firm overlying material becomes too heavy for the softer material below and causes the latter to crush, moving out laterally, and heaving at the bottom of the cut. In such cases the break at the rear of the moving mass is almost vertical and in some instances the vertical settlement of the top of the bank, due to the heaving and lateral movement below, is as much as 30 or 40 feet. In some cases there is a combination of a true "slide" with a "break," the sliding being due to clay, saturated with water, moving on an inclined surface.

Most of the smaller "slides" show no signs of failure of the softer underlying stratum, but are true slides caused by material thoroughly saturated by rains, moving on an inclined surface.

Even these small slides at times cause great annoyance and inconvenience by covering up the tracks and blocking the movement of dirt trains. The Las Cascadas slide on the east bank of the canal opposite the town of Las Cascadas is a good example of a large slide composed largely of clay sliding upon harder material. (See Pl. 108.)

It is believed that the greatest trouble with slides has already been experienced and that henceforth although they will undoubtedly continue as long as excavation is in progress, yet from present indications it appears probable that they have produced their maximum

injurious effect in the fiscal year just ended. Photographs of the principal slides accompany this report. (Pls. 34 and 35.)

## COST OF EXCAVATION.

The average cost of the various items of expense in connection with excavation is shown in the following table, giving comparison with the fiscal years 1908, 1909, and 1910:

Class of work.	1908	1909	1910	1911
<b>Loading:</b>				
Steam shovels.....	\$0.1150	\$0.1001	\$0.0888	\$0.0717
Hand.....		.3993	.3442	.2567
Drilling and blasting.....	.1413	.1149	.1190	.1048
Transportation.....	.1854	.1452	.1522	.1414
Dumps.....	.1344	.0911	.0657	.0541
Tracks.....	.1190	.0838	.1001	.1014
Division office and supervision.....	.0183	.0114	.0150	.0120
General surveys.....	.0008	.0001	.0003	.0002
Clearing site.....	.0004	.0048	.0046	.00005
Division structures.....	.0002	.0012	.0013	.0005
Drainage and sumps.....			.0052	.0038
<b>Total division cost.....</b>	.7128	.5517	.5416	.4880
General expense and administration expense <sup>1</sup> .....	.1882	.1049	.0646	.0457
Plant arbitrary <sup>2</sup> .....	.1300	.1300	.1300	.1000
<b>Total.....</b>	1.0310	.7866	.7362	.6337

<sup>1</sup> This expense is not under the control of the central division, being proportion of expenses of chairman's, chief quartermaster's, disbursing officer's, examiner of accounts' offices, etc.

<sup>2</sup> This arbitrary is intended to absorb the entire cost of all plant by the time that work is completed.

NOTE.—Yardage figures for the fiscal year ending June 30, 1911, used in determining the above costs are as follows:

	Cubic yards.
Shovel excavation.....	18,334,598
Hand excavation.....	188,094
<b>Total excavation.....</b>	18,522,692

The cost of drilling and blasting, as shown on the table, has been distributed to cover the total number of cubic yards of excavation, but to get the real cost, it should be applied to material actually mined, which amounts to 11,672,241 cubic yards, which would make the cost when thus applied \$0.1649 per cubic yard.

The increase in the cost of tracks is due to the fact that prior to July 1, 1909, all track material was charged to plant, but since that time has been absorbed in the work as purchased.

It will be noted that the division cost per cubic yard is \$0.0536 less than during the fiscal year 1910, and \$0.2248 less than during the fiscal year 1908, a satisfactory showing when the increased depth and decreased width of the cut, and the heavy rainfall are considered. This reduction in cost, it is believed, was brought about by the reorganization proposed by the division engineer and approved by the chief engineer, effective May 1, 1910 (which reduced the number of districts), by the constant study by the division engineer of daily and monthly cost sheets and by the constant and cordial cooperation and assistance of all division officials.

## COAL AND FUEL OIL CONSUMED.

The total quantity of coal used during the fiscal year amounted to 193,977 long tons. Coal is the only fuel used, except at the following

pumping stations, at which points 21,916.12 barrels of fuel oil were used during the fiscal year: Cucaracha, Mount Zion, Camacho, Gorgona, and Tabernilla.

#### STEAM SHOVEL REPAIRS.

Since November 5, 1907, the central division has had a force of boilermakers, pipefitters, and machinists, with the necessary helpers, working in the cut at night, repairing steam shovels, and it has been found by experience that greater efficiency can be obtained in steam-shovel work if all repairs possible are made in the field without sending the steam shovel to the shop for general overhauling. Since the organization of this steam-shovel night gang, circles and booms, dippers and dipper sticks, A-frames, hoisting drums, main engine shafts, propelling shafts, swinging drums, intermediate shafts, water tanks, feed pumps, trucks, and, in one or two cases, steam-shovel boilers have been changed in the cut. In fact, it is the practice to replace everything except the base castings, the deck of the shovel, and the boilers in the field.

In the interest of economy, and by direction of the chairman and chief engineer, the repairing of steam shovels and the manufacture and repair of steam-shovel parts for the entire canal were transferred to the central division, effective October 1, 1909. In order to handle this work, the Empire shops were transferred from the mechanical division to the central division, and all other mechanical work, formerly handled at the Empire shops, was transferred to the Gorgona shops. Prior to this date, the mechanical division handled all shop repairs to steam shovels and the two other construction divisions handled their own repair parts and field repairs independently. The other divisions still handle their own field repairs.

The average pay roll during the year was \$31,516.49 per month, of which 16.41 per cent, approximately, was for central division field repairs, 56.15 per cent for shop repairs for the central division, 10.57 per cent shop repairs for other divisions, and 16.87 per cent for manufacturing for all divisions.

The total number of steam shovels repaired in the Empire shops for the period above mentioned was 38 and the average time each was in the shop was 38½ days. The average number of shovels repaired in the cut each night was 20, and the average number of men employed in the night-repair gang in the cut was 13 gold and 39 silver men.

#### AIR AND WATER SERVICE.

During the fiscal year, in furnishing air connections for drills and other purposes, 2,833,760 feet of pipe were laid, while 2,605,110 feet of pipe were removed. On May 1, 1911, the maintenance of air mains leading from the air compressors was taken over from the mechanical division.

In furnishing water connections for steam shovels, orange-peel and clamshell cranes, and for other purposes 2,925,730 feet of pipe were laid, while 2,926,480 feet of pipe were removed.

## MUNICIPAL WORK.

During the fiscal year ending June 30, 1911, municipal work was carried on as in the past, the principal items of work performed being as follows:

Water pipe:		
Laid.....	feet..	19, 187
Removed.....	do.....	2, 504
Relaid.....	do.....	2, 993
Sewer pipe:		
Laid.....	do.....	7, 554
Removed.....	do.....	770
Relaid.....	do.....	503
Sanitary work:		
Regrading ditches.....	linear feet..	291, 474
Ditches dug.....	do.....	7, 177
Cleaning ditches.....	do.....	1, 707, 517
Tile drains laid.....	do.....	1, 762
Concrete gutters made.....	do.....	5, 445
Cleaning concrete drains.....	do.....	99, 515
Clearing.....	square yards..	58, 501
Miscellaneous:		
Rock crushed.....	cubic yards..	2, 512
Concrete pipe made.....	linear feet..	2, 102

## ROAD BUILDING.

The construction of a road, 12 feet wide and 18,800 feet long, from Empire to Paraiso, was completed on October 1, 1910.

The construction of a road, 12 feet wide and 16,810 feet long, from Empire to Gorgona, was completed on June 28, 1911.

With the completion of the Empire-Paraiso Road, the Empire-Gorgona Road, and the Panama-Corozal Road across Miraflores dumps, a macadam highway is opened up from Panama City to Gorgona, a distance along the line of the railroad of 18.87 miles. The wagon road makes more detours and is correspondingly longer.

Construction work was started on what is known as the Empire-Chorrera Road in April, 1911. This is a 16-foot macadam road and will be about 6 miles long in the Canal Zone and will be extended to Chorrera, a distance of about 20 miles, by the Panamanian Government. One mile of subgrading, with all necessary culverts, has been finished. This road will open up a very rich agricultural district.

The construction of a road from West Culebra to Cowpens, a length of 3,200 feet, was started in May, 1911, and by June 30, 1911, was about 75 per cent completed.

During the fiscal year 1,600 feet of street were macadamized in the settlement between Empire and Culebra, known as Golden Green.

Approximately 60 miles of trails were cleaned and drained during the year, the labor for this purpose being done by natives working out their poll tax.

In connection with the construction of the road between Empire and Gorgona, it was necessary to construct a reenforced concrete bridge over the Mandingo River, near Bas Obispo. This bridge is 12 feet wide and 196 feet long, and contains 556 cubic yards of concrete. The cost of constructing this bridge was \$7,141.97. See photograph attached. (Pl. 41.)

The following work was accomplished in connection with the maintenance of roads and cinder paths during the fiscal year:

Roads—Maintenance:

General repairs.....	square yards...	106, 246
Ditches cleaned.....	cubic yards...	352, 461
Cinder paths—General repairs.....	square yards...	9, 586

WATERWORKS.

The use of the Rio Grande, Camacho, and Carabali Reservoirs for the purpose of supplying the various settlements with water was continued throughout the year, and the pumping stations at Paraiso, Cucaracha, Lirio, Camacho, Gamboa, Point 4, Gorgona, Tabernilla, and Bohio were operated during the year. The pumping station at Mount Zion was in operation until April 6, 1911, when this station was closed down and the pumping heretofore done at this point was performed at the Cucaracha pumping station, with the addition of two high-pressure pumps. The pumps at Bas Obispo and Chagres were held for emergency use. The condenser plants at Las Cascadas, Bas Obispo, and San Pablo were operated during the year, condensing daily an average of 2,650 gallons of water.

Approximately 369,380,000 gallons were consumed by the central division from the Rio Grande Reservoir, which is operated by the Pacific division. The daily average consumption from the Camacho Reservoir was 1,850,000 gallons. The daily average consumption from the Carabali Reservoir was 975,000 gallons.

The total number of pumps in service at the different pumping stations was 23. The daily average number of pumps in operation at the various stations was 16. The daily average number of gallons pumped at the different pumping stations was 2,584,609; total for the year, 943,382,447 gallons. The daily average number of gallons condensed at the various stations was 10,276 and the total for the year 3,751,821.

During the fiscal year the summit of drainage was at a point in the canal opposite Empire. All water entering the canal south of this point is now drained into the Pacific Ocean by the sump pumps at Pedro Miguel. All water which enters the cut north of this point is pumped into the Chagres River by the sump pumps at Bas Obispo. At the close of the fiscal year three duplex pumps, 16 by 22 by 18 inches, capacity 4,200 gallons per minute each; 2 Wagner pumps, 16 by 8 by 12 inches, capacity 445 gallons per minute; 1 Worthington centrifugal pump, 24-inch discharge, capacity 18,000 gallons per minute, and 2 French centrifugal pumps, 17-inch discharge, capacity 7,000 gallons per minute each, were in operation at the sump at Bas Obispo for the purpose of pumping water from the north end of the cut into the Chagres River. The piston pumps are arranged to operate by air or steam so that they can work under water for a considerable time. At the sump which drains into the Pacific the following pumps were installed temporarily about March 1, 1911, with a capacity of approximately 38,250 gallons per minute; two 16-inch centrifugal, three 10-inch centrifugal, one 12-inch centrifugal, one 6-inch centrifugal, one 10-inch Therion, one 8-inch Wagner, and one 6-inch Wagner. These pumps will be removed as soon as the open-

ing for the drainage through the Pedro Miguel locks is completed, after which time the south end of the cut will drain by gravity.

#### LABOR SITUATION.

During the fiscal year of 1911 the labor situation was quite satisfactory, the supply of laborers being greater than the demand for most of the year. This is largely due to the fact that a number of noncontract Spanish and Italian laborers have come to the Isthmus looking for work.

By far the larger number of laborers in the central division are West Indian negroes, but the percentage of Spaniards and Italians remains about the same as during the previous fiscal year. The average daily number of laborers employed in the central division for the fiscal year just ended was 8,735.

#### CHANGES IN ORGANIZATION.

On August 11, 1910, the department of municipal engineering and the air and water service department were combined under the head of municipal work and pipe lines. The superintendent of water service having resigned, the superintendent of municipal work was placed in charge of the combined departments.

On September 24, 1910, the position of general superintendent of construction was abolished and the position of general inspector was created September 25, 1910.

On March 31, 1911, the position of lidgerwood inspector was abolished and the duties of this position were assumed by Traveling Engineer D. E. Irwin, of the office of the chairman and chief engineer.

On April 1, 1911, the maintenance of all air mains from the air receivers at each compressor was turned over to the central division, the work in connection therewith being placed in charge of the superintendent of municipal work and pipe lines.

In April, 1911, plans were made for the prosecution of clearing work in the bed of Gatun Lake, in the vicinity of Bohio, under the supervision of Assistant Engineer W. F. Beyer, of the chairman and chief engineer's office. The actual clearing work commenced about April 20, 1911. This work is being done in connection with the location and referencing of beacons and buoys, turning points, ranges, lights, etc., for the guidance of vessels passing through Gatun Lake.

Steam-shovel excavation in the north end of the central division (Chagres district) was practically completed April 20, 1911, with the exception of excavating through the Panama Railroad bed at San Pablo and Tabernilla, and the work being performed in the canal prism by contractors for the Isthmian Canal Commission at Point 4-B, Tabernilla and Bohio. This necessitated a general reduction in force in the Chagres district, most of the men being transferred to other districts or divisions. The district time office at San Pablo was closed and a new office established on the east side of the canal at Gamboa.

On May 10, 1911, the engineering offices at Las Cascadas and Paraiso were abolished, and all engineering work was transferred to the office of the resident engineer at Empire, resulting in the con-

solidation of the two districts and a reduction of the engineering force.

On May 17, 1911, the supervision of the upkeep of steam-shovel repair parts was turned over to the quartermaster's department.

#### CHANGES IN PERSONNEL.

On July 11, 1910, the resignation of Louis K. Rourke, assistant division engineer, which was tendered in the preceding fiscal year, became effective.

On August 11, 1910, Daniel E. Wright appointed superintendent of municipal work and pipe lines.

On August 17, 1910, Edward E. Rigney, superintendent of air and water service, resigned.

C. P. Gibson, assistant superintendent of construction, Empire district, resigned, effective September 11, 1910.

L. A. O'Neal appointed assistant superintendent of construction, Empire district, effective September 24, 1910, vice C. P. Gibson, resigned.

George A. Greenslade, general superintendent of construction, resigned, effective September 24, 1910, and his position abolished.

A. Earl Bronk appointed general inspector, effective September 25, 1910.

Walter I. Beam appointed chief clerk, effective September 25, 1910, vice A. Earl Bronk, promoted.

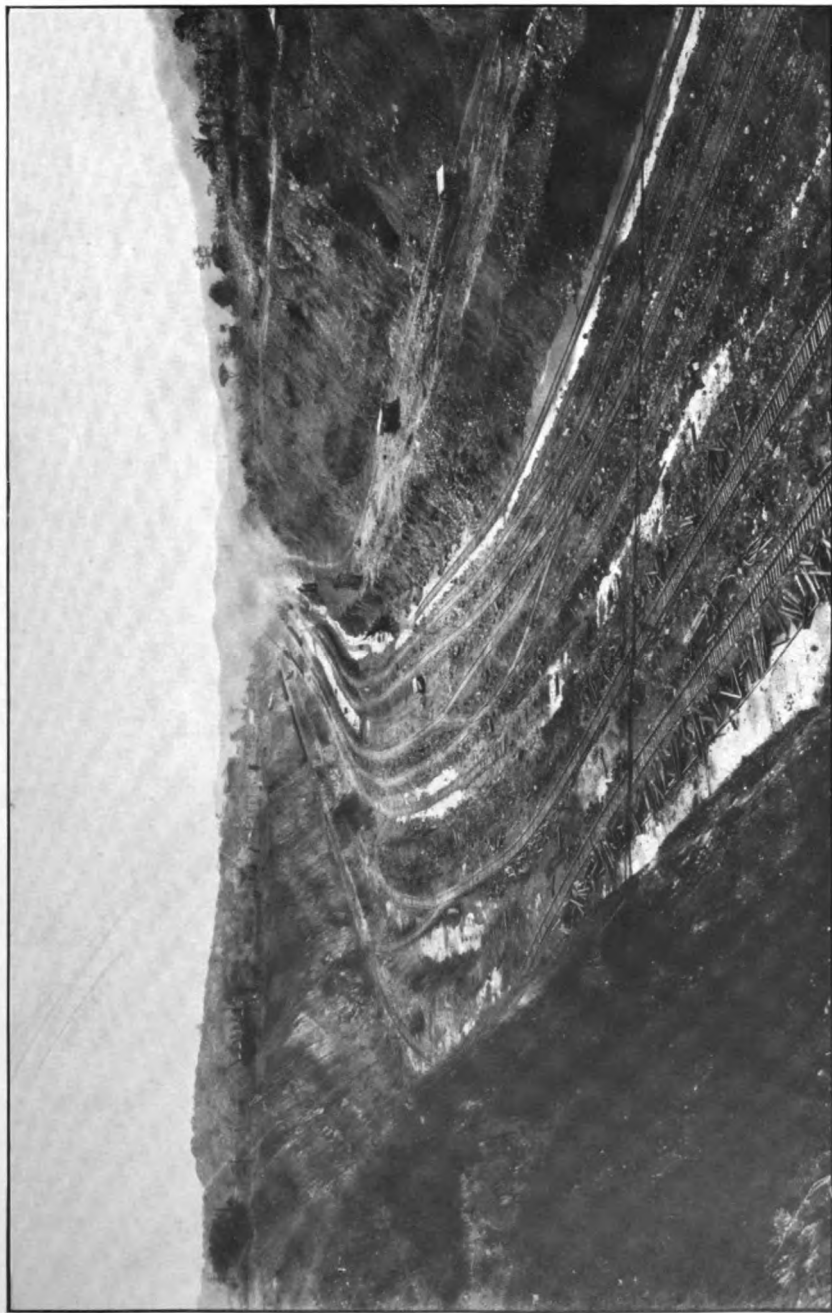
William L. Thompson, assistant engineer, transferred to the Pacific division, effective May 8, 1911, and his position abolished.

Effective May 10, 1911, Mark W. Tenny, assistant engineer, took charge of additional territory made by consolidation of Paraiso and Las Cascadas districts.

Respectively submitted.

D. D. GAILLARD,  
*Lieutenant Colonel, Corps of Engineers, U. S. Army,*  
*Member of Isthmian Canal Commission,*  
*Division Engineer, Central Division.*

Col. GEORGE W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer,*  
*Isthmian Canal Commission, Culebra, Canal Zone.*



CULEBRA CUT LOOKING NORTH FROM CUNETTE ANGLE, NORTH OF EMPIRE. ANGLE 29° 24', THE LARGEST ON THE 300-FOOT CHANNEL, JUNE, 1911.







CULEBRA CUT OPPOSITE PARAISO AND JUST NORTH OF PANAMA RAILROAD BRIDGE No. 571. SHOVEL WORKING AT BOTTOM OF CANAL, JUNE, 1911.





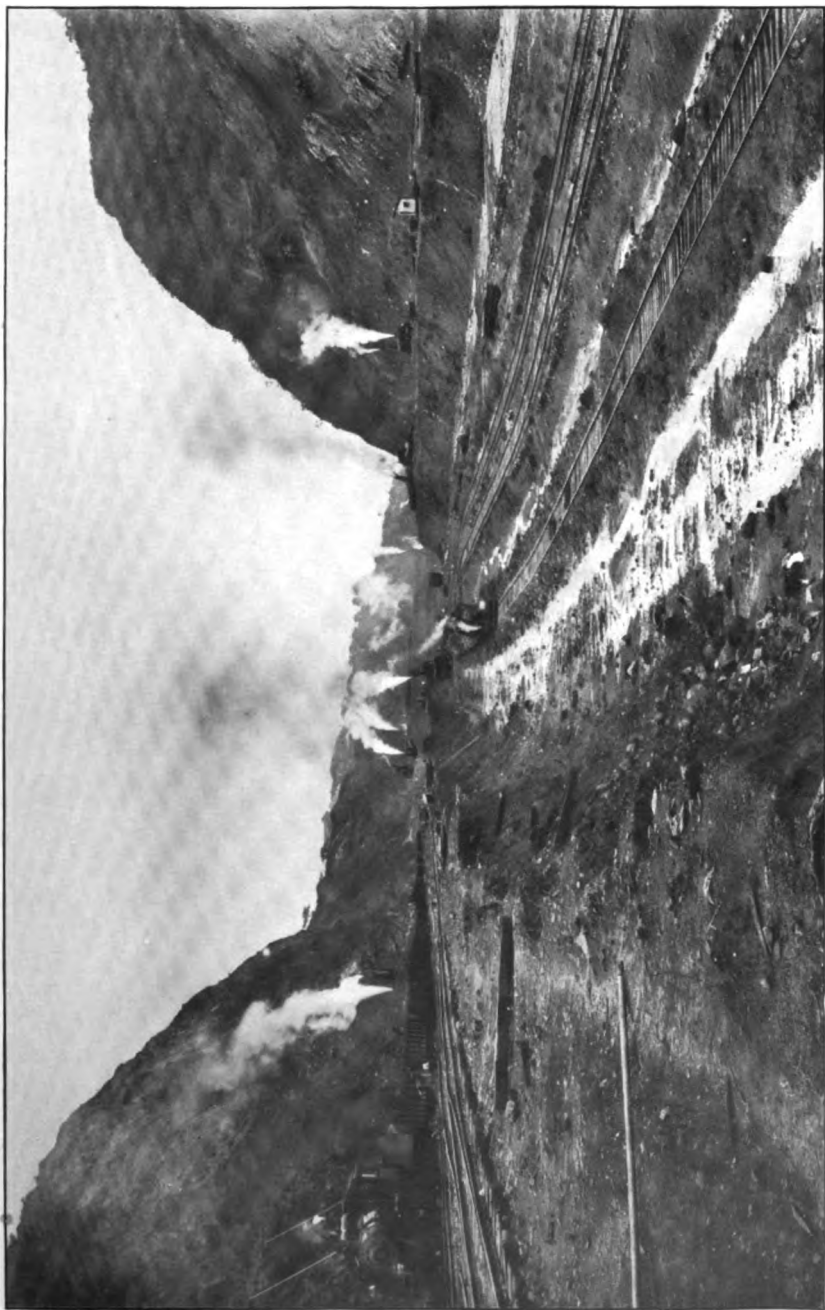
CULEBRA CUT OPPOSITE LAS CASCADAS, LOOKING SOUTH, JUNE, 1911.





CULEBRA CUT AT EMPIRE SUSPENSION BRIDGE. BOTTOM OF CUT TO BE 57 FEET LOWER WHERE THE CARS STAND, JUNE, 1911.

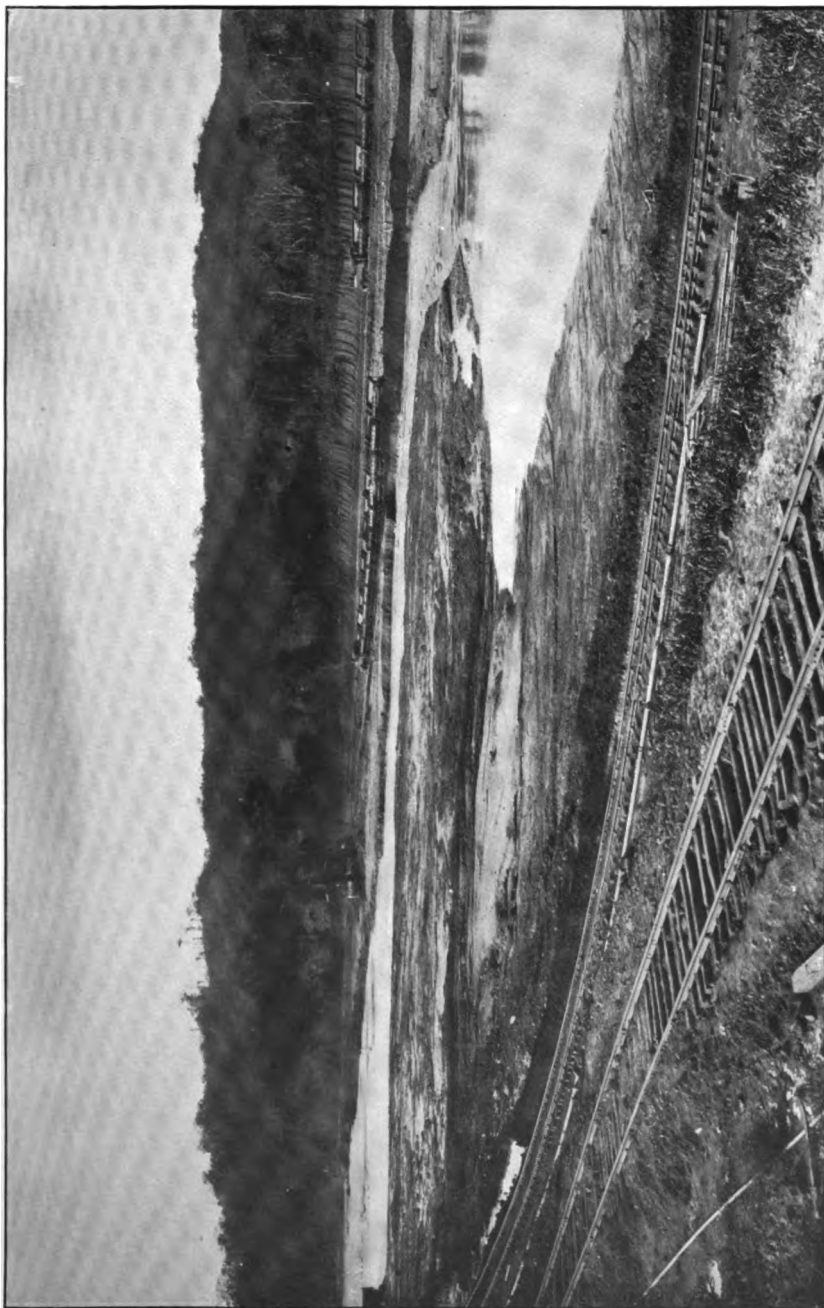




CULEBRA CUT LOOKING NORTH, BETWEEN CONTRACTORS HILL AND GOLD HILL. BOTTOM OF CANAL TO BE 45 FEET BELOW LOWEST PART OF CUT, JUNE, 1911.

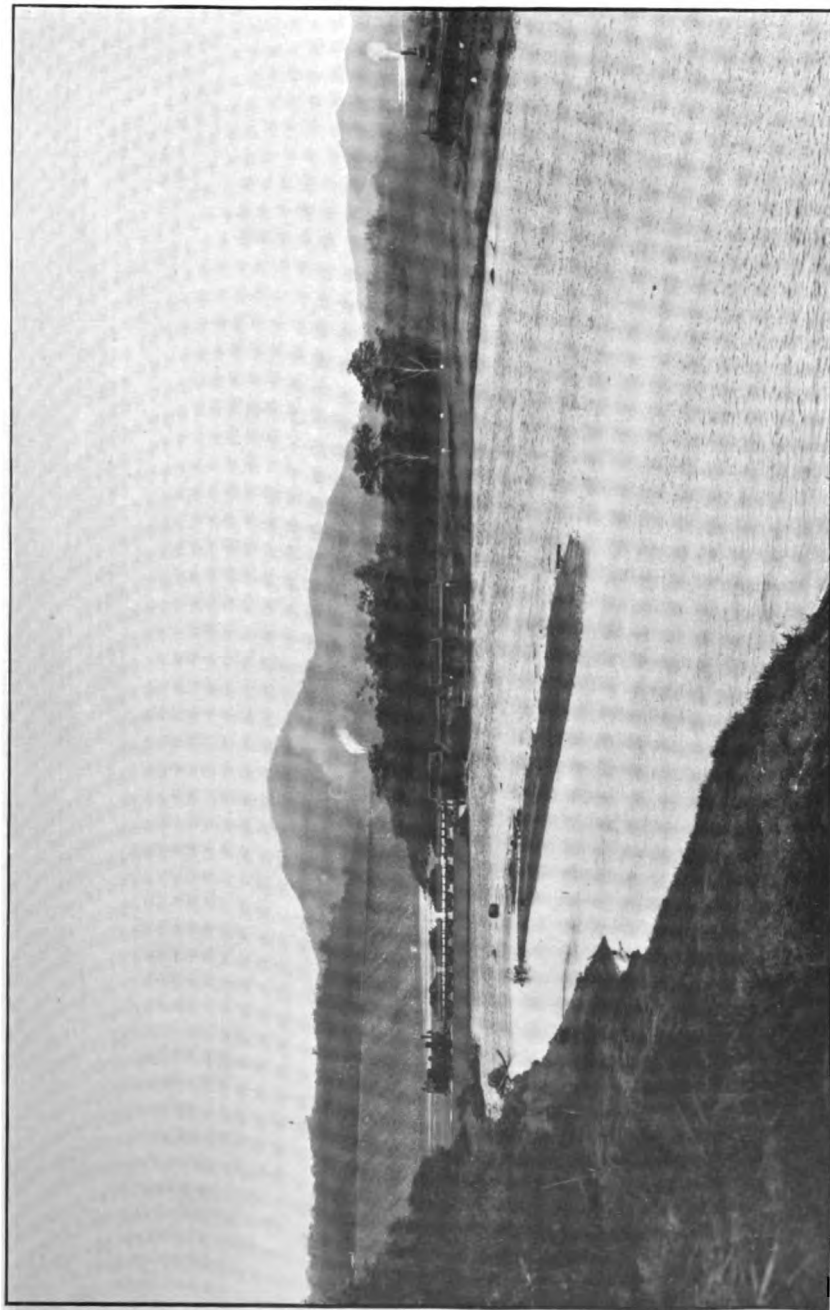






EXCAVATION AT BOTTOM OF CANAL OPPOSITE JUAN GRANDE, SHOWING MATERIAL WASHED INTO THE RIVER. A CHEAP METHOD OF DISPOSING OF MATERIAL BY SHORT HAUL AND SLUICING.





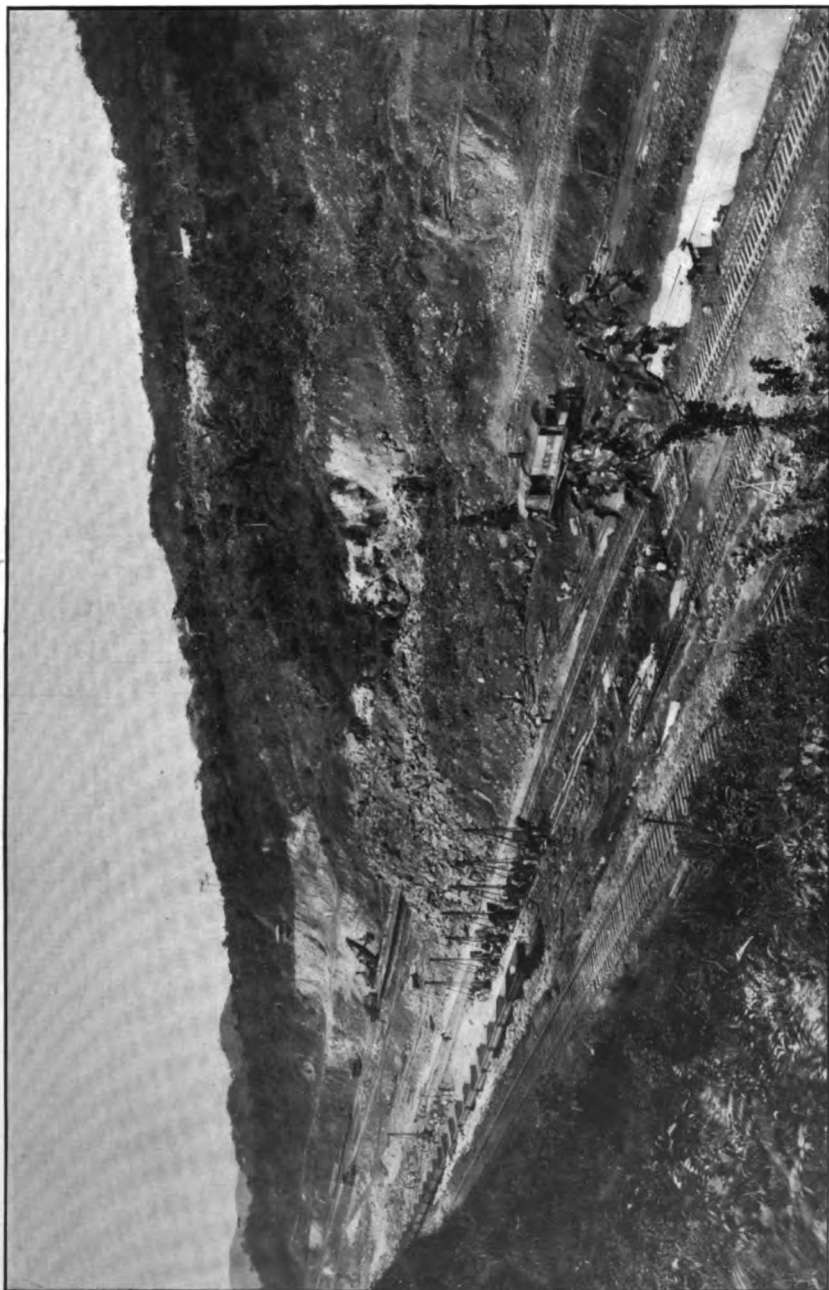
LOW TRESTLE DUMP ACROSS CHAGRES RIVER AT POINT NO. 4, NEAR GORGONA. MATERIAL WASHED AWAY BY THE RIVER.  
A CHEAP METHOD OF DISPOSING OF MATERIAL BY SHORT HAUL.





CULEBRA CUT. SLIDE IN EAST BANK, LOOKING ACROSS THE CUT FROM THE WEST BANK AT CULEBRA, FEBRUARY 10, 1911.

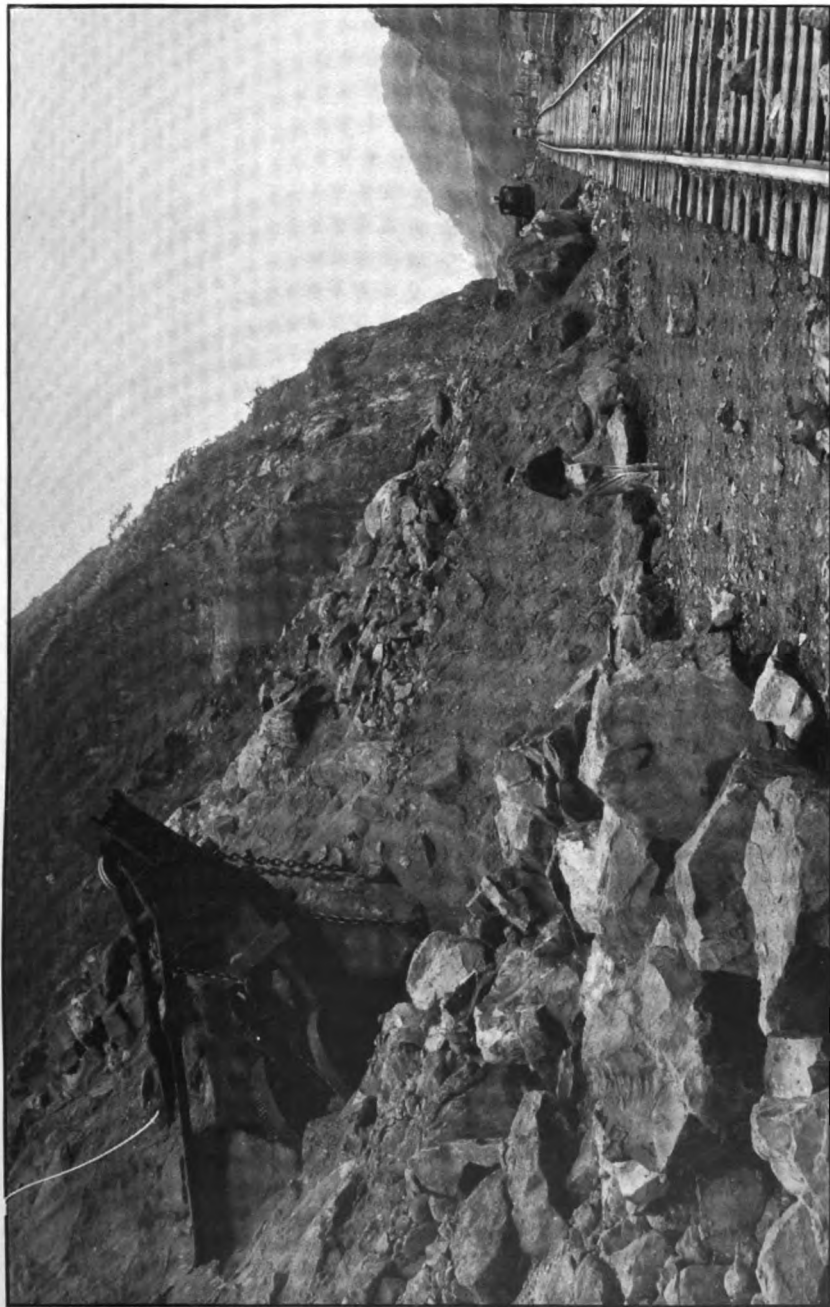




LAS CASCADAS SLIDE, LOOKING ACROSS FROM THE WEST BANK OF THE CANAL, DECEMBER 15, 1910.

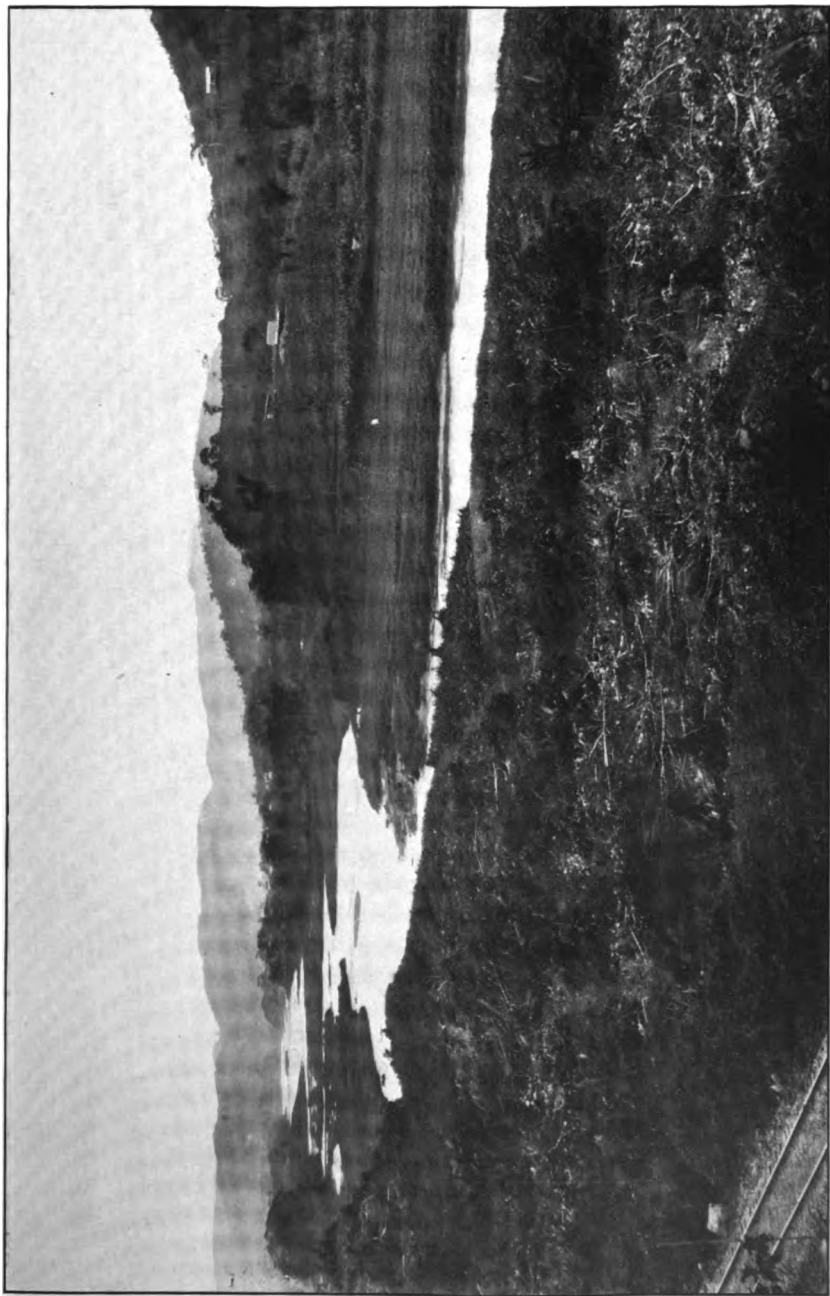






STEAM SHOVEL NO. 225, WRECKED BY ROCK SLIDE, NORTH OF GOLD HILL, JULY 4, 1911.





LOOKING SOUTH NEAR MAMEI, SHOWING STRAIGHTENING OF CHAGRES RIVER INTO A 500-FOOT CHANNEL. EXCAVATION BY STEAM SHOVELS, JUNE, 1911.

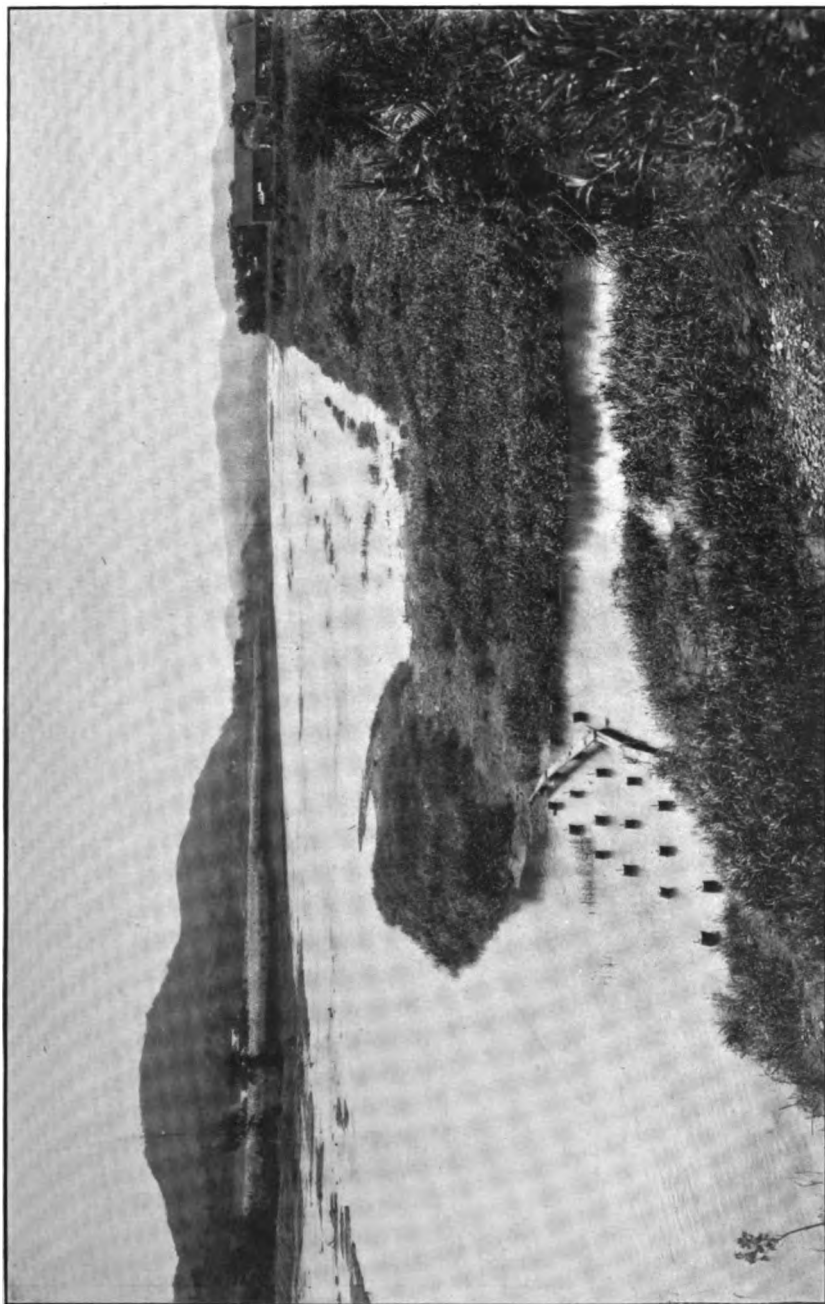




POINT NO. 5, LOOKING SOUTH, SHOWING COMPLETED CHANNEL, 500 FEET WIDE, JUNE, 1911.



PLATE 39.



POINT NO. 4, NEAR GORGONA, LOOKING SOUTH, SHOWING COMPLETED CHANNEL, 500 FEET WIDE, MAY, 1911.





PLATE 40.



WAGON ROAD NEAR BAS OBISPO, JUNE, 1911.

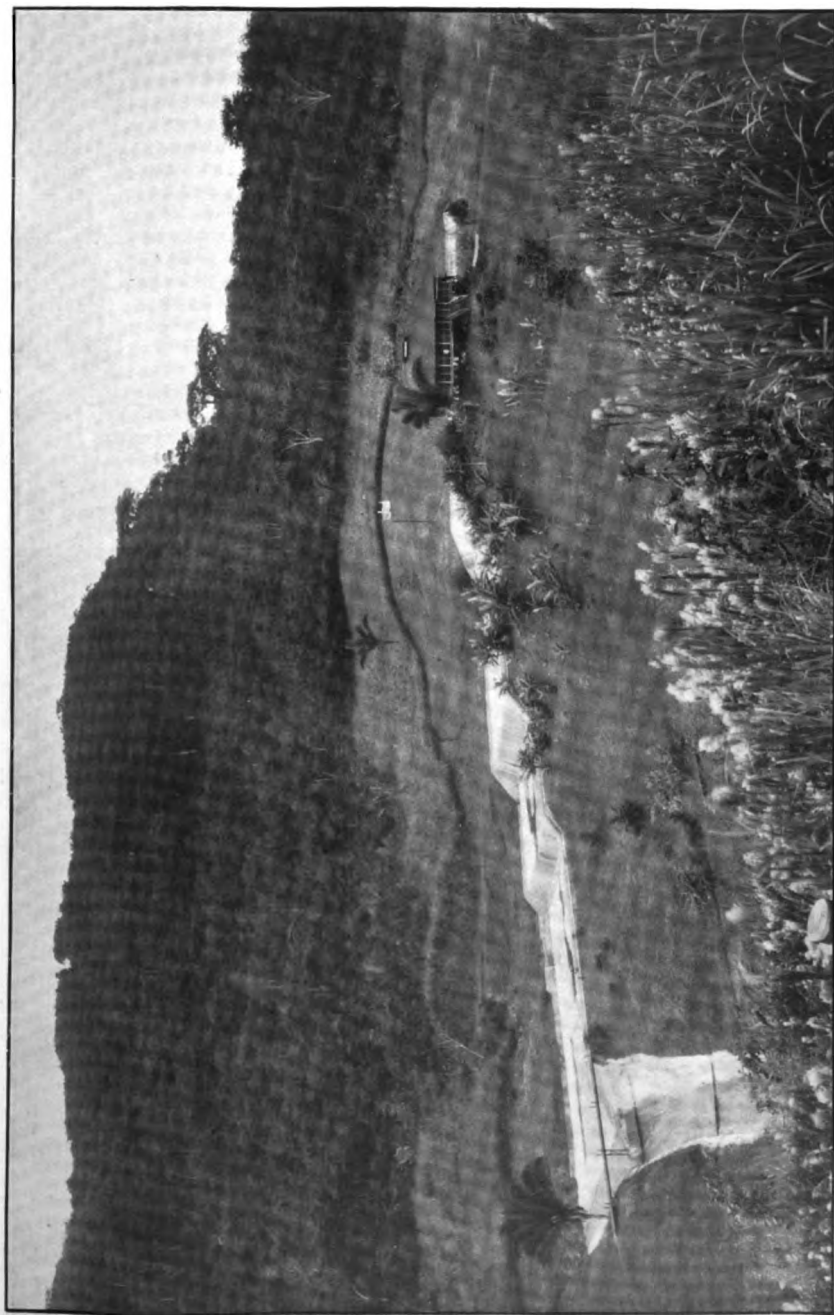


PLATE 41.



REINFORCED CONCRETE WAGON BRIDGE OVER THE MANDINGO RIVER, NEAR BAS OBISPO, JUNE, 1911.

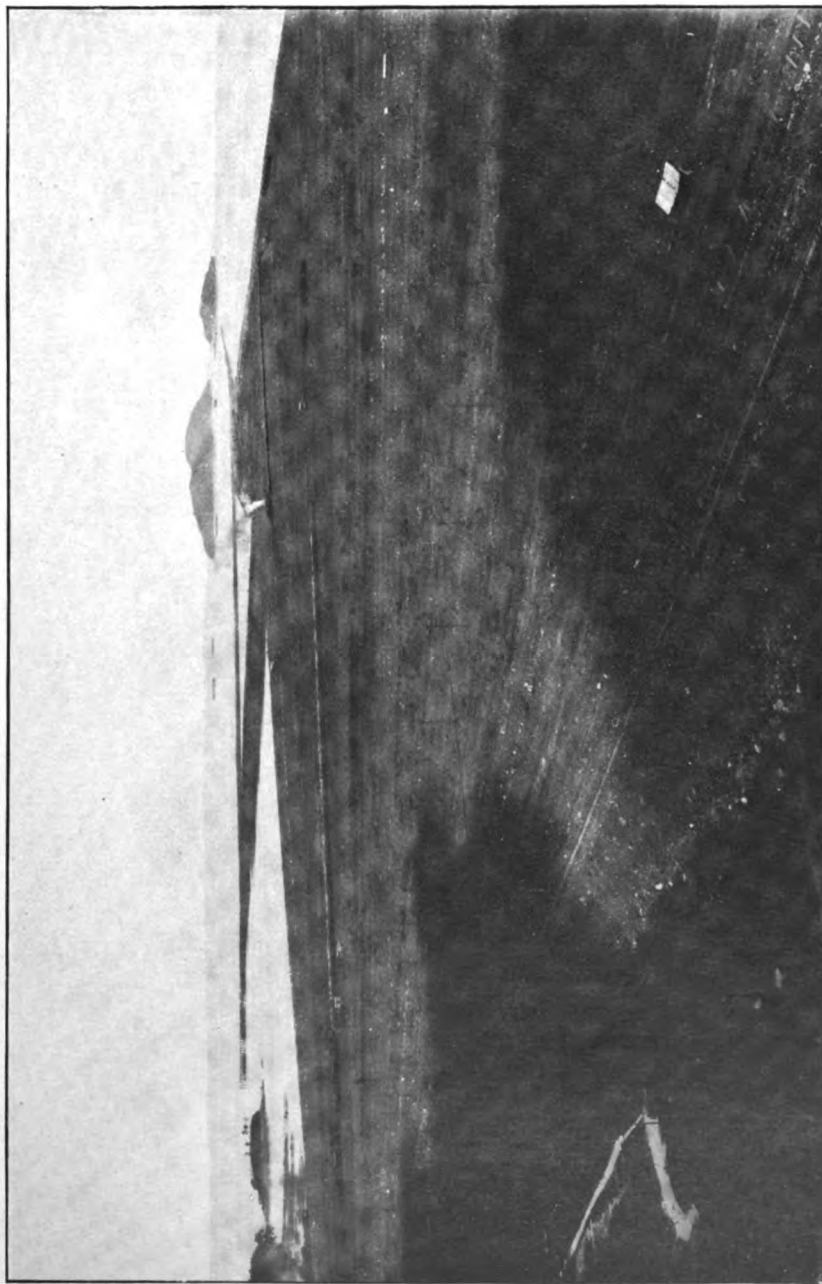




CONCRETE SPILLWAY, EAST SIDE OF DAM AT CAMACHO RESERVOIR, SOUTHWEST OF EMPIRE.



PLATE 43.



DUMPS LEADING TO NAOS ISLAND BREAKWATER. VIEW FROM SOSA HILL LOOKING SOUTH, JUNE, 1911.





## APPENDIX D.

### REPORT OF S. B. WILLIAMSON, DIVISION ENGINEER, PACIFIC DIVISION.

ISTHMIAN CANAL COMMISSION,  
DEPARTMENT OF CONSTRUCTION AND ENGINEERING,  
PACIFIC DIVISION, OFFICE OF THE DIVISION ENGINEER,  
*Corozal, Canal Zone, July 31, 1911.*

SIR: I have the honor to submit the following report of operations in the Pacific division during the fiscal year ended June 30, 1911:

#### DIVISION ORGANIZATION.

The division extends from mile 39.53 immediately north of Pedro Miguel to deep water in the Pacific Ocean, covering a distance of 11 miles, and is subdivided as follows: First district—locks, dams, and dry excavation; second district—dredging, Balboa shops, and shipways; third district—municipal and sanitary engineering; fourth district—Ancon quarry and crushers; fifth district—hydraulic excavation.

The present organization is shown by districts on Plate 132.

The following changes have occurred during the year: Mr. H. O. Cole was appointed resident engineer of the first district on April 20, 1911, to fill the vacancy caused through the death of Mr. W. B. Corse; Mr. Frank Cotton succeeded Mr. Cole as assistant engineer in charge of the third district, and on May 8, 1911, Mr. W. L. Thompson, assistant engineer, was placed in charge of the fifth district. The division suffered a distinct loss through the death of Mr. Corse, as the very satisfactory results as to quality and cost of concrete obtained in the past year are largely due to his energy, ability, and able management.

A summary of the principal items of work performed is given in Table 1.

TABLE 1.—*Principal items of work performed in year ended June 30, 1911.*

Class of work.	Unit.	Quantity.
Dry excavation:		
Work.....	Cubic yards.....	1,749,146
Plant.....	do.....	1,285
Dredge excavation:		
Work.....	do.....	5,549,642
Plant.....	do.....	775,698
Hydraulic excavation work.....	do.....	530,380
Explosives used.....	Gross tons.....	333.32
Rock drilling.....	Linear feet.....	619,047
Wash drilling.....	do.....	26,730
New track laid.....	Miles.....	33.19
Frame trestle built.....	Linear feet.....	3,810
Piles driven.....	Number.....	1,220

TABLE 1.—Principal items of work performed in year ended June 30, 1911—Continued.

Class of work.	Unit.	Quantity.
Dam filling:		
Wet .....	Cubic yards.....	444, 145
Dry .....	do.....	295, 598
Back filling.....	do.....	321, 230
Concrete placed.....	do.....	771, 120
Rock crushed.....	do.....	855, 824
Sand production.....	do.....	494, 841
New roads built.....	Miles.....	5. 48
Roads maintained.....	do.....	10. 54
Drains and ditches dug.....	Linear feet.....	42, 937
Drains and ditches cleaned and graded.....	do.....	536, 851
Water pipe laid.....	do.....	31, 732
Sewer pipe laid.....	do.....	8, 453
Clearing and grubbing.....	Acres.....	51. 37
Daily average number of laborers.....	Number.....	4, 254

## FIRST DISTRICT.

## LOCKS, DAMS, AND DRY EXCAVATION.

[H. O. Cole, resident engineer.]

## PEDRO MIGUEL LOCKS AND DAMS.

The work consisted in excavating; preparing the lock foundations; manufacturing and erecting forms; placing concrete and fixed iron work for the valves, lock gates, and fender chains; back filling the lock walls, and filling the west dam.

## LOCK EXCAVATION.

The lock excavation, including several slides, for the Pedro Miguel locks was completed during the fiscal year by the removal of 16,423 cubic yards, making a total of 824,724 cubic yards excavated from the lock site exclusive of the material removed in preparing the foundations.

TABLE 2.—Pedro Miguel lock excavation.

Months.	Number of working days.	Material excavated.			Average number of shovels.	Average per day per shovel.	Rainfall.
		Earth.	Rock.	Total.			
1910.		<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>			<i>Inches.</i>
July.....							8. 95
August.....							10. 08
September.....							7. 68
October.....							13. 42
November.....							10. 02
December.....							9. 61
1911.							
January.....	25. 1	3, 367	3, 367	6, 734	0. 82	327. 18	. 03
February.....	24. 2	2, 576	2, 577	5, 153	. 91	233. 99	1. 40
March.....							. 03
April.....							5. 24
May.....							9. 57
June.....	25. 9		3, 838	3, 838	. 37	400. 50	5. 52
Total.....	75. 2	5, 943	9, 782	15, 725	. 70	320. 56	80. 65

## MINING.

The following work was performed in mining the material excavated:

Drilling with power drills.....	linear feet..	13, 636
Drilling by hand.....	do....	None.
Total.....		13, 636
Explosives used.....	gross tons..	1. 68

## CONSTRUCTION TRACKS.

All tracks for construction purposes were maintained and relocated when necessary. Eight and eighty-five hundredths miles of new tracks were laid.

## LOCK FOUNDATIONS.

Preparing the lock foundations involved the removal of loose rock left by the steam shovels, and the excavation, below floor level, required for wall footings, lateral culverts, sumps, etc. Under the prevailing conditions the greater portion was removed with picks and shovels, loaded into skips and handled by means of locomotive cranes or derricks, though steam shovels were used when practicable. Seventy-six thousand eight hundred and forty-seven cubic yards were handled during the year, and the total to date is 140,931 cubic yards.

The following work was performed in moving the above material:

Drilling with power drills.....	linear feet..	62, 342
Drilling by hand.....	do....	None.
Total.....		62, 342
Explosives used.....	gross tons..	7. 69

TABLE 3.—Excavation for foundations—Pedro Miguel Lock.

Months.	Cubic yards.
<b>1910.</b>	
July.....	4, 410
August.....	12, 789
September.....	10, 405
October.....	7, 433
November.....	10, 636
December.....	11, 195
<b>1911.</b>	
January.....	8, 956
February.....	1, 656
March.....	674
April.....	255
May.....	5, 520
June.....	2, 918
Total.....	76, 847

## PLACING CONCRETE.

The total amount of concrete placed in the Pedro Miguel Lock during the fiscal year is 498,187 cubic yards. The construction plant began operations in its entirety on July 15, 1910, and laid 376,657 cubic yards of the above amount; it worked as a whole until January 31, 1911, when the dismantling of one of the berm or mixing cranes began, preparatory to moving it to Miraflores. Dismantling of the first chamber crane began on April 20, 1911, and of the second on May 9, 1911; and that of the remaining berm crane on May 19, 1911. Two

chamber cranes still remain at Pedro Miguel and are used for placing concrete from auxiliary mixers, setting iron work, and back filling the center wall. The remaining 121,530 cubic yards of concrete were mixed mainly by three 2-cubic-yard auxiliary mixers; one of these was located at the south end of the east wall, and the other two in the forebay, at the south ends of the east and west storage trestles, respectively. The total amount of concrete that has been laid in the Pedro Miguel Lock prior to June 30, 1911, is 665,055 cubic yards, and the estimated amount remaining is 172,345 cubic yards. The progress is shown graphically on Plate 110, and the performances of the construction and auxiliary plants, respectively, are given in the following tables:

TABLE 4.—Performance of berm cranes, 1910–11.

Months.	Number of cranes.	Number of mixers (2 cubic yards).	Concrete mixed.	Service time of mixers.					Rate per hour per mixer.		Working time to time in service.	
				Hours working.	Hours delay.				Total hours per month.	Working time.		Total time.
					Repairs to cranes.	Repairs to mixers.	Waiting for cars.	Other delays.				
1910.												
July.....	2.00	4.00	34,890	630.50	49.50	1.67	214.16	4.17	900.00	55.3	38.8	0.7016
August.....	2.00	4.00	50,808	767.37	34.21	4.33	152.67	13.42	972.00	66.2	52.8	.7985
September..	2.00	4.00	49,852	683.09	15.30	24.08	170.00	10.53	903.00	73.0	55.2	.7562
October.....	1.96	3.93	55,152	683.33	96.35	12.67	157.07	1.00	953.42	80.4	58.0	.7214
November..	2.00	4.00	49,568	622.82	45.75	3.50	181.27	8.83	862.17	79.6	57.5	.7224
December..	1.73	3.15	31,156	427.49	8.34	.....	275.52	2.18	713.53	72.9	43.7	.5994
1911.												
January.....	1.72	2.76	35,640	427.42	12.66	5.00	131.99	6.84	583.91	83.4	61.0	.7314
February....	1.00	2.00	23,770	321.33	25.00	2.32	62.68	6.67	418.00	74.0	56.9	.7687
March.....	1.00	2.00	25,704	396.51	13.67	1.50	103.16	11.17	526.00	64.8	48.9	.7538
April.....	1.00	2.00	17,188	296.33	22.00	.67	105.50	7.50	432.00	58.0	39.8	.6859
May.....	1.00	2.00	5,462	135.00	11.00	.....	160.00	.....	306.00	40.5	17.8	.4412
June.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 5.—Performance of chamber cranes, 1910–11.

Months.	Number of cranes.	Material placed.			Hours working.	Service time.				Total hours per month.	Rate per hour per crane.		Working time to time in service.
		Concrete.	Stone.	Total.		Repairs to cranes.	Waiting for concrete.	Waiting for forms.	Other delays.		Working time.	Total time.	
1910.													
July.....	3.56	32,121	205	32,326	639.30	31.32	41.53	16.59	17.28	746.02	50.6	43.3	0.8557
August.....	4.00	48,224	334	48,558	786.51	55.97	43.27	19.25	24.98	929.98	61.7	52.2	.8460
September..	3.96	49,022	466	49,488	659.41	23.69	78.67	60.76	39.82	862.35	74.9	57.4	.7664
October.....	3.93	54,126	137	54,263	710.46	28.92	138.82	38.85	40.99	958.04	76.2	56.5	.7415
November..	4.00	48,438	15	48,453	647.97	24.67	70.87	85.99	19.67	849.17	74.8	57.1	.7634
December..	3.66	30,836	211	31,047	466.09	18.04	25.67	269.76	46.47	826.03	66.6	37.6	.5646
1911.													
January.....	3.68	33,870	32	33,902	524.80	14.15	49.77	168.09	43.22	800.03	64.6	42.4	.6563
February....	4.00	28,420	6	28,426	483.19	15.21	67.43	185.90	66.27	818.00	58.8	34.8	.5907
March.....	4.00	35,117	1	35,118	588.92	9.63	129.41	157.34	118.67	1,004.00	59.6	35.0	.5866
April.....	3.40	22,594	8	22,602	390.31	23.76	73.23	166.68	84.02	738.00	67.9	30.6	.5288
May.....	1.79	11,388	.....	11,388	199.70	4.76	69.37	52.95	60.22	378.00	57.0	30.1	.5283
June.....	1.38	7,568	15	7,584	133.33	2.08	75.42	53.01	55.66	319.50	56.8	23.7	.4173

TABLE 6.—*Performance of auxiliary concrete plant, Pedro Miguel.*

Months.	Mixers used.		Working time (average per mixer).			Concrete placed (all mixers).			
	Average number.	Size.	Days.	Hours.		Per day.	Per hour.	Total.	Per mixer hour.
				Per day.	Total.				
1910.		<i>Cu. yds.</i>				<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
July.....	1.00	2	25	6.81	170.33	205.60	29.88	5,090	29.88
August.....	1.00	2	1	9.00	9.00	154.00	17.11	154	17.11
September.....	1.00	2	9	4.83	43.50	99.56	20.60	896	20.60
October.....	1.42	2	24	3.75	89.88	230.50	61.64	5,532	43.34
November.....	2.00	2	24	5.77	138.45	510.42	88.48	12,250	44.24
December.....	2.42	2	26	4.53	117.75	451.65	96.73	11,743	41.21
1911.									
January.....	1.67	2	24	5.00	120.11	299.84	59.92	7,196	35.88
February.....	2.61	2	23	5.18	119.10	550.96	106.41	12,672	40.77
March.....	1.00	2	17	2.16	36.75	22.35	10.34	380	10.34
April.....	2.93	2	27	5.18	139.99	639.00	123.24	17,253	42.06
May.....	1.00	2	24	7.10	170.50	115.71	16.29	2,777	16.29
June.....	2.00	2	24	5.39	129.38	455.75	84.54	10,938	42.27
July.....	1.67	2	23	5.45	125.32	122.56	22.50	2,819	14.33
August.....	1.55	2	26	5.45	141.07	476.54	87.83	12,390	53.23
September.....	1.32	2	22	5.00	110.04	77.55	15.61	1,706	11.75
October.....	2.78	2	27	5.18	139.93	626.04	120.79	16,903	43.45
November.....	1.29	2	17	5.48	93.16	96.82	17.67	1,646	13.70

With the construction plant, concrete was mixed on the berm cranes and transported by a narrow-gauge railroad to the chamber cranes which placed it in the forms. In the above tables the amount of concrete handled by the two types of cranes does not agree, as some of the berm cranes' output was placed by derricks and the chamber cranes placed a portion of the concrete mixed by the auxiliary plant.

The average performance of the construction plant is shown in the tables. The maximum daily output for the construction plant was 3,048 cubic yards mixed and placed in 9.11 hours actual working time and 11 hours total elapsed time, giving an average of 83.6 and 69.3 cubic yards per mixer hour for working and elapsed time, respectively. The maximum performance per mixer was obtained on January 13, 1911, when only one berm crane was in operation and mixed 1,628 cubic yards in 7 hours actual working time or 8 hours elapsed time, giving an average of 117 cubic yards and 102 cubic yards per mixer hour for working and elapsed time, respectively. The maximum performance for a chamber crane was 780 cubic yards in a day of 10 hours working and 11 hours elapsed time, or an average of 78 cubic yards and 71 cubic yards per hour, respectively. The maximum daily output of the combined construction and auxiliary plants was 3,844 cubic yards in 9 working hours, or 11 hours elapsed time.

It will be noted that the monthly output of concrete began to fall off in December, 1910. This is due, first, to the masonry work having reached the upper portion of the walls, where the construction of the machinery chambers, electrical conduits, etc., necessitated a large amount of complicated forming for placing a comparatively small amount of concrete (see photographs, Plates 49 and 50); second, the placing of fixed irons, such as valve frames, gate, fender chain, and machinery anchorages was begun at this time and the accurate

assembling and adjusting required for these caused a very material though unavoidable delay in placing concrete. The aggregate weight of the fixed irons referred to above that have been placed to June 30, 1911, is 7,063,915 pounds.

#### CONCRETE FORMS.

The forms used for straight walls were described and illustrated in the annual report for 1910. A number of special forms have been manufactured; most of them were so designed as to be used a number of times. Some of these are illustrated on Plates 111 to 113, inclusive. The cost and number of times they were used is shown in the following table:

TABLE 7.—*Special wooden forms for lock construction.*

Designation.	Times used.	Total cost.	Cost per usage.
Connection of side-wall culverts and laterals (Pl. 111) .....	10	\$250. 00	\$25. 00
Cylindrical valve chambers (Pl. 112) .....	7-10	75. 00	\$10. 75-7. 50
Connection of center-wall culverts and laterals (Pl. 113) .....	6-10	9. 00	1. 50-. 90
Snubbing-hook recess.....	10	25. 00	2. 50
Tee culvert T form .....	4	200. 00	50. 00
Tee culvert L form .....	4	350. 00	87. 50
Reverse curve, main-culvert forms (Pl. 47) .....	6	1, 050. 00	175. 00

#### BACK FILLING.

Back filling the Pedro Miguel lock walls was continued intermittently throughout the year, the following having been accomplished:

Filling behind east wall.....	cubic yards..	50, 838
Filling behind west wall.....	do.....	221, 437
Filling in center wall.....	do....	1, 434
Total.....		273, 709

#### FILLING WEST DAM.

The west dam at Pedro Miguel can not be completed until the drainage from the central division is diverted from the site. This is to be done in July of the present year by allowing the drainage to pass through the center-wall culvert of the lock. For the above reason, mainly, no filling was added to the dam in the past year, though a small amount might have been placed had suitable material been excavated from the canal prism in the immediate vicinity. A trestle has been driven for the purpose of continuing the west toe toward the north, and it is proposed to complete the dam before the end of the next dry season.

#### MISCELLANEOUS WORK.

The principal items of miscellaneous work performed at Pedro Miguel were: the preparation of storage yards and tracks for the lock-gate contractors; removing the east storage trestle from the forebay, and making the necessary arrangements for passing the central division drainage through the center-wall culvert.

## MIRAFLORES LOCKS AND DAMS.

The lock excavation, construction of the west dam, erection of concrete plant, preparing foundations and placing concrete were continued during the year.

## DRY EXCAVATION.

Excavation in the upper lock was completed and the steam shovels moved to the lower lock. The total amount excavated during the year was 247,700 cubic yards, exclusive of preparing foundations; of this, 40,676 cubic yards were used for backfilling and 207,024 cubic yards were placed in the toes of the west dam.

TABLE 8.—*Miraflores lock excavation.*

Months.	Number of 8-hour work days.	Material excavated.			Average number of shovels.	Average per day per shovel.	Rainfall.
		Earth.	Rock.	Total.			
1910.		<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>		<i>Cubic yards.</i>	<i>Inches.</i>
July.....							11.31
August.....							11.97
September.....							9.56
October.....							13.40
November.....							10.20
December.....							8.71
1911.							
January.....	24.2	13,762		13,762	0.90	631.86	.27
February.....							2.43
March.....	33.9	51,379	12,000	63,379	3.09	605.04	.00
April.....	24.0	77,521		77,521	5.17	624.77	2.86
May.....	37.4	56,295		56,295	2.32	648.80	10.16
June.....	36.3	36,743		36,743	1.40	723.00	8.71
Total.....	155.8	235,700	12,000	247,700	2.58	646.70	84.58

## MINING.

The following mining work was performed in connection with the above excavations:

Drilling with power drills.....	linear feet..	200,027
Drilling with hand drills.....	do.....	None.
Total.....		200,027
Explosives used.....	gross tons..	29.62

## CONSTRUCTION TRACKS.

In addition to maintaining and moving tracks as required, 24.39 miles of new construction tracks were laid in connection with the work at Miraflores.

## LOCK FOUNDATIONS.

In preparing the foundation for the upper lock 137,752 cubic yards of material were removed, requiring 104,755 linear feet of drilling and the use of 15.51 gross tons of explosives.



TABLE 9.—*Excavation for foundations: Miraflores locks.*

Months.	Cubic yards.
1910.	
July.....	11,990
August.....	17,548
September.....	8,590
October.....	9,850
November.....	9,400
December.....	17,906
1911.	
January.....	34,982
February.....	12,936
March.....	9,360
April.....	2,230
May.....	1,680
June.....	1,280
Total.....	137,752

## ERECTING HANDLING PLANT.

The storage trestles on both sides of the locks were completed and 156,571 cubic yards of crushed rock and 164,980 cubic yards of sand are now in storage. One berm crane, located on the east side of the lock site, was completed, except for the cantilever arm and mixers, on September 2, 1910, and placed concrete supplied by auxiliary mixers until assembling the cantilever began, on February 15, 1911; the machine was finally completed and began operations on March 22, 1911. The second berm crane was assembled on the west side of the lock site and put in commission on April 7, 1911; the third is under erection on the west side and should be completed in July, and the fourth is being dismantled at Pedro Miguel. One chamber crane has been erected at Miraflores and will begin placing concrete in July; the second one is being assembled.

The auxiliary plant at Miraflores consists of two 2-cubic-yard mixers and four  $\frac{1}{2}$ -cubic-yard mixers; the former were installed in the east trestle until about the middle of May; they were then removed to a position on the east wall for the purpose of supplying concrete to the chamber cranes for the construction of the center wall. The half-yard mixers were moved as required and have been used for placing concrete in the floors, lateral culverts, miter sills, and foundations of the main walls.

## PLACING CONCRETE.

The aggregate amount of concrete placed in the Miraflores locks during the past year is 272,933 cubic yards. The partly completed construction plant placed 67,678 cubic yards, and the remaining 205,255 cubic yards were mixed by the auxiliary plant. The progress is shown graphically on Plate 114, and the performances of the plants are given in the following tables:

TABLE 10.—*Construction plant: Performance of berm cranes.*

Months.	Mixers used.		Working time (average per mixer).			Concrete placed (all mixers).			
	Average num- ber.	Size (cubic yards).	Days.	Hours.		Per day.	Per hour.	Total.	Per mixer hour.
				Per day.	Total.				
1911.						<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
March.....	2	2	9	3.77	33.92	235.78	62.54	2,122	31.28
April.....	3.65	2	23	5.59	128.61	727.65	130.06	16,736	35.66
May.....	3.7	2	26	5.87	152.62	941.54	160.39	24,480	43.35
June.....	3.84	2	26	5.52	143.44	939.85	170.34	24,436	44.36

TABLE 11.—*Auxiliary plant: Performance of mixers.*

Months.	Mixers used.		Working time (average per mixer).			Concrete placed (all mixers).			
	Average num- ber.	Size (cubic yards).	Days.	Hours.		Per day.	Per hour.	Total.	Per mixer hour.
				Per day.	Total.				
1910.						<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
July.....	1.73	1	26	7.81	203.13	117.46	8.69	3,054	5.02
	1.00	1	22	7.38	162.33	28.11	3.81	618	3.81
August.....	2.00	1	27	7.64	206.17	171.14	11.21	4,621	5.60
	1.00	1	27	7.83	211.41	40.78	5.21	1,101	5.21
	1.46	2	24	5.60	134.50	382.63	46.79	9,188	32.05
September.....	3.56	1	25	6.95	173.88	316.48	12.78	7,912	3.56
	1.00	1	15	6.36	95.30	46.33	7.29	695	7.29
	2.00	2	27	3.57	96.50	373.93	52.31	10,096	26.16
October.....	3.43	1	28	6.91	193.51	409.48	17.27	11,465	5.04
	2.00	2	24	4.22	101.21	482.67	57.23	11,584	28.61
November.....	3.58	1	24	6.73	161.47	405.35	16.83	9,729	4.70
	1.00	1	24	7.10	170.41	78.40	11.04	1,881	11.04
	2.00	2	26	3.88	100.79	453.77	58.52	11,798	29.26
December.....	3.27	1	26	6.05	157.31	294.92	14.91	7,668	4.56
	1.00	1	24	5.76	138.25	67.46	11.71	1,619	11.71
1911.	2.00	2	25	5.80	144.95	457.76	39.48	11,444	19.74
January....	3.92	1	25	6.43	160.73	398.16	15.80	9,954	4.03
	1.00	1	23	6.55	150.70	84.87	12.95	1,952	12.95
	1.87	2	23	4.72	108.55	424.35	48.08	9,760	25.71
February.....	3.70	1	23	6.15	141.35	384.26	16.90	8,838	4.57
	1.00	1	21	6.37	133.75	84.00	13.19	1,764	13.19
	2.00	2	27	3.29	88.90	295.74	44.90	7,984	22.45
March.....	5.26	1	27	7.20	194.31	699.11	18.49	18,876	3.51
	1.00	1	26	5.79	150.50	70.46	12.17	1,832	12.17
	2.00	2	24	2.40	57.59	242.75	50.62	5,826	25.31
April.....	6.08	1	24	7.11	170.59	720.54	16.67	17,293	2.74
	1.00	1	16	7.20	115.19	70.06	9.73	1,121	9.73
	1.92	2	22	3.24	71.27	170.73	27.59	3,756	14.45
May.....	3.28	1	25	5.97	149.24	349.84	17.87	8,746	5.45
	1.00	1	17	6.06	103.00	57.18	9.44	972	9.44
June.....	3.19	1	26	6.00	156.88	301.15	15.75	7,830	4.94

## CONCRETE FORMS.

The various types of forms used are the same as have been described for Pedro Miguel, and some of these have been transferred from Pedro Miguel to Miraflores after serving their purpose at the former place.

## WEST DAM.

The hydraulic excavating plant began work in September, 1910, and has deposited 444,145 cubic yards of impervious material from

the canal prism into the core of the dam; in addition, 295,598 cubic yards from the dry excavation have been placed in the toes.

On May 24, 1911, the temporary spillway used for discharging the clear water from the hydraulic filling gave way apparently through the undercutting of the outer toe and about 4 feet of the upper stratum of water and silt escaped. The total volume that ran off measured 96,000 cubic yards, and while it is impossible to give exact figures, there is usually about 18 inches of clear water on top of the pool; assuming that the above condition existed at the time of the accident, the loss consisted of 36,000 cubic yards of clear water and 60,000 cubic yards of slime containing probably 60 per cent, or 36,000 cubic yards, of solid matter. The unfortunate part of the accident was that a large proportion of the run-off got into the Miraflores lock pit and seriously interfered with the prosecution of the work for several days.

#### BACK FILLING.

The east wall of the upper lock has been partly back filled with 40,676 cubic yards of material from the lock excavation.

#### DRY EXCAVATION IN PRISM.

Within the past five months 197,880 cubic yards of material were excavated from channel between the Pedro Miguel and Miraflores Locks and just south of the latter.

TABLE 12.—*Excavation in canal prism.*

Months.	Number of 8-hour work days.	Material excavated.			Average number of shovels.	Average per day per shovel.	Rainfall.
		Earth.	Rock.	Total.			
1910.		<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>		<i>Cubic yards.</i>	<i>Inches.</i>
July.....	24.9	890		890	0.34	105.13	8.95
1911.							
February.....	34.7	15,271		15,271	1.55	283.93	2.43
March.....	30.7	27,834		27,834	1.97	460.23	.01
April.....	23.9	42,792	3,072	45,864	3.52	545.17	4.05
May.....	29.6	33,445		33,445	2.60	434.58	9.86
June.....	31.8	61,209	14,257	75,466	3.89	610.06	4.12
Total.....	175.6	181,441	17,329	198,770	2.31	406.52	

#### SECOND DISTRICT.

##### DREDGING, BALBOA SHOPS AND SHIPWAYS.

[W. G. Comber, resident engineer.]

#### DREDGING.

The following dredges were operated throughout the year:

TABLE 13.—*Pacific division dredges.*

Names.	Type.	Remarks.
Culebra.....	Suction dredge (seagoing).....	Out of commission 16 days for repairs.
Cardenas.....	5-yard dipper dredge.....	Out of commission 51 days for repairs.
Gopher.....	French ladder dredge (marine).....	Out of commission 16 days for repairs.
Badger.....	French ladder dredge.....	Out of commission 17 days for repairs.
Mole.....	French ladder dredge (marine).....	Do.
Marmot.....	French ladder dredge.....	Out of commission 10 days for repairs.

## MOVEMENT OF DREDGES.

The *Culebra* was engaged in deepening the canal from the Pacific entrance northward to station 2110 and in dredging a channel to the lumber dock under construction.

The *Cardenas* operated in the channel between stations 2116 and 2250, removing both earth and rock; it was also employed in deepening the berths in front of the sand dock and the Panama Railroad Co.'s commercial and coaling docks.

The *Gopher* was engaged during the entire year at Chame excavating sand for concrete work.

The *Badger* was employed in widening the channel and removing rock shoals previously broken by the rock breaker or drill scow; the dredge operated between stations 2108 and 2212.

The *Mole* dredged for the greater portion of the year on the rock shoals at stations 2180, 2225, and 2285, removing rock broken by the rock-breaking machines.

The *Marmot* widened and deepened the main channel as far north as station 2095.

The monthly output of all dredges, excepting the *Gopher*, was as follows:

TABLE 14.—Dredging output, Pacific division.

Months.	Culebra.	Cardenas.	Badger.	Mole.	Marmot.	Total.
	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
1910.						
July.....	240,645	61,943	91,931	22,645	93,618	515,782
August.....	245,741	70,287	95,704	15,210	98,027	524,969
September.....	226,650	76,200	65,939	9,924	112,072	490,785
October.....	279,588	61,940	53,368	23,515	73,812	492,223
November.....	289,757	55,808	64,740	15,475	133,181	559,051
December.....	280,174	22,312	63,641	20,907	219,795	606,829
1911.						
January.....	252,844	58,364	57,751	12,251	186,136	567,346
February.....	251,256	50,727	68,588	11,817	105,711	488,099
March.....	243,734	81,011	121,615	11,226	102,892	560,478
April.....	185,947	49,961	90,834	24,546	64,251	415,539
May.....	255,707	83,702	120,233	20,480	80,916	561,038
June.....	241,745	71,494	94,786	29,900	105,276	543,201
Total.....	2,993,788	743,839	989,030	217,896	1,380,687	6,325,340

At the close of the fiscal year there remains 4,693,211 cubic yards of earth to be dredged from the channel south of the Miraflores locks, including an estimate for siltage.

## ROCK EXCAVATION.

South of station 2142 the rock found in the canal section lies in separate shoals of relatively small area and volume and is being removed by subaqueous methods. The table following shows the location and extent of the shoals as well as the amount of rock removed during the year.

TABLE 15.—*Subaqueous rock excavation.*

Months.	Location.	Area broken.	Volume excavated.	Method of breaking.
		<i>Square feet.</i>	<i>Cubic yards.</i>	
1910.				
July.....	Stations 2225, 2209 to 2212, 2201 to 2203, 2190 to 2194 plus 50.	41,812	22,024	Vulcan and well drills.
August.....	Stations 2225, 2285, 2198 plus 75 to 2201, 2207.	46,672	12,620	Do.
September...	Stations 2225, 2285, 2178 to 2181, 2195 to 2198.	85,428	32,963	Do.
October.....	Stations 2225, 2285, 2217 plus 50, 2175, 2177, 2167 to 2170.	74,762	61,762	Do.
November...	Stations 2225, 2172 to 2175 plus 50, 2200 to 2202.	71,480	39,271	Do.
December...	Station 2180.....	64,960	3,900	Vulcan.
1911.				
January.....	Stations 2180, 2225, 2160 plus 75, 2163, 2190 to 2193.	84,142	31,443	Vulcan and well drills.
February.....	Stations 2285, 2225, 2163 plus 50, 2164, 2160 to 2164.	61,677	24,347	Do.
March.....	Stations 2225, 2160 to 2163.....	77,796	26,591	Do.
April.....	Stations 2225, 2180, 2255, 2160 plus 75 to 2164 plus 25.	97,552	20,563	Do.
May.....	Stations 2180, 2250, 2160 to 2164, 2123 to 2132.	94,158	23,190	Vulcan, Teredo, and well drills
June.....	Station 2225.....	45,504	3,050	Vulcan.
Total.....			301,112	

Three methods are used to break the rock for dredging, viz, drilling with well drills through the overlying earth, drilling under water with a drill scow, and breaking below water with a Lobnitz rock breaker. The first two methods require the use of explosives.

## OPERATION OF WELL DRILLS.

With an average of 10.5 well drills in commission, the work contemplated for this type of drill was completed on April 4, 1911. The method consisted in sinking the drills through the overlying earth by means of pipe casing, then drilling the required depth into the rock. All holes were sprung before final blasting.

TABLE 16.—*Performance of well drills and dredges.*

Months.	Average number of drills.	Linear feet drilled.				Dynamite.	Rock.	
		Earth.	Rock.	Total.	Per drill.		Broken (estimated).	Dredged (actual).
1910.						<i>Pounds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
July.....	15	1,580	4,889	6,469	431	28,189	34,991	17,074
August.....	15	1,939	5,235	7,174	478	21,955	27,708	5,810
September.....	15	3,909	5,523	9,432	629	49,967	56,452	28,439
October.....	14	6,014	4,623	10,637	759	47,872	42,058	57,235
November.....	11	3,421	3,562	6,983	635	41,360	31,884	34,671
December.....	10	2,216	3,534	5,750	575	25,604	31,121	.....
1911.								
January.....	7	424	1,810	2,234	319	12,540	16,182	29,315
February.....	8	155	1,834	1,989	248	2,927	3,075	19,680
March.....	6	98	2,011	2,109	352	.....	.....	22,450
April.....	4	.....	182	182	45	7,313	8,341	15,487
May.....	.....	.....	.....	.....	.....	.....	.....	21,685
June.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	10.5	19,756	33,203	52,959	4,472	237,727	251,812	251,819

## OPERATION OF DRILL BARGE.

The drill barge *Teredo* operated throughout the year, except during a portion of the month of February, 1911, when it was laid up for a general overhauling and the substitution of heavier drill towers; it was also equipped with Dake hoisting engines. Subsequent to August, 1910, it has been operated with two 10-hour shifts each day, and the performance is shown in the table following:

TABLE 17.—Performance of drill barge *Teredo*.

Months.	Drilling.			Blasting.		Dredging.	
	Linear feet.	Hours worked.	Feet per hour.	Number of holes blasted.	Dynamite used.	Area covered.	Cubic yards dredged.
						<i>Sq. ft.</i>	
1910.					<i>Pounds.</i>		
July.....	2,348	339	6.9	129	2,408	4,020	.....
August.....	4,180	661	6.6	264	4,168	7,920	.....
September.....	3,953	664	5.9	261	4,771	7,960	.....
October.....	4,576	633	7.2	297	5,534	9,210	.....
November.....	5,208	622	8.4	388	6,634	11,640	.....
December.....	4,395	592	7.4	311	5,874	9,330	.....
1911.							
January.....	11,408	857	13.3	665	13,684	19,950	.....
February.....	6,763	429	15.8	304	11,289	9,120	.....
March.....	24,588	1,300	18.9	1,562	46,418	46,800	.....
April.....	22,278	1,132	19.6	1,448	40,812	43,440	.....
May.....	21,513	1,268	16.9	1,265	44,263	37,950	1,300
June.....	20,983	1,150	18.2	1,344	41,740	40,320	.....
Total.....	132,193	9,647	12.1	8,238	227,595	247,560	1,300

(<sup>1</sup>) This amount of material should not be taken as an indication of the capacity of the drill barge, as all the rock broken by its operations during the year was not taken out on account of lack of available dredges; the amount taken out in May having been removed in order to determine whether or not a sufficient amount of explosives was being used to properly shatter the rock.

## OPERATION OF LOBNITZ ROCK BREAKER.

The rock breaker *Vulcan*, described in the last annual report, was in commission throughout the year. The work was carried on by two 10-hour shifts until about the 1st of March, 1911; since then only one shift has been used, as the shoals have been removed to a depth that made it impossible, with the range of tides, to work more than a single shift without changing the rams.

TABLE 18.—Performance of rock breaker *Vulcan*.

Months.	Rock breaker.						Dredges.	
	Number of holes.	Number of blows.	Total penetration.	Blows per hole.	Penetration per blow.	Penetration per hole.	Area covered.	Cubic yards dredged.
							<i>Sq. ft.</i>	
1910.			<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>		
July.....	2,046	15,009	7,414	7.33	0.494	3.62	37,792	4,950
August.....	2,332	17,764	10,666	7.62	.600	4.57	38,752	6,810
September.....	4,848	30,389	20,642	6.27	.679	4.26	77,568	4,524
October.....	4,097	31,601	21,803	7.71	.690	5.32	65,552	3,915
November.....	3,740	29,195	22,828	7.81	.782	6.10	59,840	4,600
December.....	4,060	24,072	21,672	5.93	.900	5.33	64,960	3,900
1911.								
January.....	3,972	30,874	19,212	7.77	.622	4.83	64,192	2,128
February.....	3,836	25,678	17,347	6.69	.676	4.53	52,557	4,667
March.....	3,440	17,892	7,688	5.20	.430	2.23	30,996	4,141
April.....	3,382	15,414	12,289	4.56	.797	3.03	54,112	5,076
May.....	3,513	16,187	11,833	4.61	.731	3.37	56,208	1,506
June.....	2,844	15,164	8,722	5.33	.575	3.07	45,504	3,050
Total.....	42,110	269,239	182,116	6.40	.664	4.24	648,033	49,266

## SAND FOR CONCRETE.

Sand for the lock masonry and other concrete construction is obtained from a bay formed by Point Chame and located about 20 miles up the coast from Balboa. It is dredged with the ladder dredge *Gopher*, loaded into barges of 500 cubic yards capacity, towed to Balboa, and transferred to bins by rapid unloading cranes; from the bins it is loaded by gravity into dump cars and transported to the storage piles at the lock site or to such other points as desired.

TABLE 19.—*Sand supplied—Performance of dredge "Gopher."*

Months. *	Cubic yards of sand supplied.			
	Atlantic division.	Pacific division.	Other departments.	Total.
1910.				
July.....	16,474	18,360	1,465	36,299
August.....	845	38,536	896	40,277
September.....	50	41,665	785	42,500
October.....	75	45,672	685	46,432
November.....	75	42,566	520	43,161
December.....	95	41,740	685	42,520
1911.				
January.....	75	40,110	945	41,130
February.....	217	35,670	385	36,272
March.....	698	40,005	1,175	41,878
April.....	418	35,590	655	36,663
May.....	533	34,640	730	35,903
June.....	259	50,872	675	51,806
Total.....	19,814	465,426	9,601	494,841

## BALBOA SHOPS AND SHIPWAYS.

All necessary running repairs have been made to the plant and floating equipment. No new equipment was assembled or erected during the year.

## RENEWALS AND REPAIRS.

Dredge *Culebra*: In addition to running repairs, the hull was cleaned and painted; the propellers, suction pipes, and main pump runners were renewed and the machinery given a general overhauling.

Ladder dredges *Badger*, *Gopher*, *Marmot*, and *Mole*: In addition to the usual repairs, the *Badger* and *Gopher* were equipped with new tumblers, and the *Marmot* and *Mole* with new ladders and tumbler wheels.

## MISCELLANEOUS.

All tugs, scows, barges, and small boats were kept in good condition; and numerous repairs were made for the Panama Railroad Co., commercial vessels entering the port of Balboa, and for other departments and divisions.

## WHARF CONSTRUCTION.

## LOCATION.

Additional docking facilities being required immediately by the Panama Railroad at Balboa, it was decided to construct a reinforced concrete dock, 706 feet long by 55 feet wide, located so as to form a

part of the ultimate terminal scheme contemplated for the Pacific entrance to the canal. The type and general location of the dock are shown on Plate 115.

A tidal inlet, with entrance at north end of sand dock, crossed the dock site. It was necessary to shut this off by a cofferdam, constructed near the entrance. Two centrifugal pumps were installed for keeping the old bed of the inlet dry. The dock will thus be constructed on what is almost entirely dry land, and dredging may be started whenever the piers are completed.

#### FOUNDATIONS.

The character of the material for foundations was determined by a line of borings and a test pit, sunk along the outer edge of the proposed dock (see Pl. 115). For about 20 feet sand is encountered; this changes to a heavy bluish-gray clay which continues some distance, when a layer of sand and gravel a few feet thick is found overlying the bedrock. The latter is a variety of argillaceous sandstone, and was found in the borings at depths varying from 60 to 70 feet below mean sea level.

#### CONSTRUCTION OF PIERS.

In building the piers a heavily reenforced concrete shell, built in 6-foot sections, is forced down to rock and the interior then filled with concrete. The bottom section is a hollow frustum of a cone, interior diameter 6 feet throughout, exterior diameter 10 feet at the base, tapering to 8 feet at the top. The purpose of the enlarged footing thus formed is to minimize skin friction while the pier is going down and also to bring the unit pressure on the foundation well within the allowable limit. From the top of the footing section the 8-foot exterior diameter is maintained to the top of the entire pier, giving a cylindrical shell 1 foot in thickness. (See Pl. 115.) A steel shoe attached to the bottom of the footing serves at once as the bottom concrete form and also as a cutting edge.

Two methods of construction have been employed—in the first, the footing was modeled, partially filled with concrete and lowered by crane into position. The successive sections, after subsequently completing the footing, were then built up in place whenever the progress of sinking required. This interfered with the sinking operations, the steel and forms were difficult to handle on account of the limited standing room, the concrete had to be placed laboriously by hand and required a reasonable length of time to set before the work of sinking could be resumed. These difficulties led to casting 6-foot sections on the ground near one of the mixers. In these the vertical reinforcement does not pass through the joint between sections, but bond is given by means of 6 vertical iron rods, made continuous by stout square junctions threaded at each end to receive the rods. By this method any number of sections may be built in advance and become well seasoned before required for use. They are handled by crane and lowered into position, the rods which project from the preceding section passing through holes left in the section being lowered. The top surface of each section is so molded as to leave the inner half of the ring about 1 inch higher than the outer half; the lower surface corresponds. The sections then fit



into each other, the joint being strengthened by a rich cement mortar. The footing and 3 feet of cylindrical shell are made as before, the upper surface of this 3-foot section being prepared to receive one of the sections cast on the ground.

Collapsible steel forms are employed in 6-foot lengths for the inside and 3-foot lengths for the outside forms. The footing has a special outside form.

The concrete used in the shell is a 1:2:4 mixture; that for the filling is 1:3:5. The interior of the cylinder is reinforced against bending with French rails, as shown in section of pier (Pl. 115).

#### SINKING PIERS.

It was at first proposed to sink the piers by water jets, pipes passing down through the shell and contracting into a nozzle at the bottom being inserted for this purpose. The material, especially the clay stratum, is so heavy, compact, and stiff that a pressure of about 120 pounds to the square inch brought about scarcely any penetration. Orangepeel excavation in the upper strata proved to be less efficient than hand excavation, so the latter has been finally resorted to and carried out wherever practicable.

There were on hand several Star drills, and these have been utilized as windlasses for raising and lowering specially constructed buckets of about 5 cubic feet capacity into the piers. Two or three men work with shovels at the bottom of the pit, taking material from under the shoe and gradually leveling off; the caissons then sink of their own weight.

At about 25 feet depth a brown spongy material, saturated with sulphuretted hydrogen gas, is encountered. While passing through this stratum, the laborers' eyes become very much inflamed, hospital treatment being necessary in some cases.

At about elevation -43, the clay becomes saturated and extremely soft and the caissons take a sudden drop of from 3 to 6 feet, due solely to their weight, no excavation being necessary to accomplish this. The material forces its way up inside the caisson from the bottom to distances of from 12 to 15 feet. From this point down water is present practically until the rock is met with, difficulty of its control making it impracticable to continue hand excavation. The orangepeel bucket, operated from one of the cranes, accomplishes the work, and just before reaching rock the material again becomes almost impervious, allowing the men to enter and adjust the steel shoe to the foundation. The shoe is embedded for about 1 foot in the rock, and a conical depression is formed at the bottom, either by hand or by means of a small charge of dynamite; this gives the concrete used for filling a firm bond with rock foundation.

#### SUPERSTRUCTURE.

The tie girders for giving stiffness to the piers run transversely between piers, and longitudinally between outside piers at an elevation of -10. The cross section is 3 feet 6 inches deep by 2 feet 6 inches wide. The floor system consists of girders running perpendicular to axis of dock, cross sectional dimensions, 4 feet 8 inches

deep by 2 feet 6 inches wide. Arrangement of reinforcing steel is shown in Plate 115. The girders support a system of floor beams running longitudinally along the dock, 3 feet 9 inches deep by 1 foot 3 inches wide. On top of the whole is a reinforced slab 6 inches thick. The system is designed to support a uniformly distributed live load of 400 pounds per square foot, and a concentrated live load over the track beams equivalent to the weight of the 301-class locomotive. The track comes immediately over the outer line of piers, curving off at each end over the extra piers shown in the plan of the dock.

#### PLANT.

The main elements comprise 2 locomotive cranes, one having capacity of 15 tons at 10 feet, the other 20 tons at 12 feet; 3 concrete mixers, two of  $\frac{1}{2}$  cubic yard and the third of  $\frac{3}{4}$  cubic yard capacity; 6 No. 1 and 2 No. 3 Emerson pumps, for keeping the cylinders dry during sinking; a marine boiler, which, however, furnishes power to other units besides the dock proper; and about a dozen Star drills. The pumps are operated by steam from the boiler, and the cranes and 1 mixer by self-generated steam; the remainder of the plant by compressed air.

#### PROGRESS OF WORK.

Caisson construction was begun the last week in February, and work on sinking the first caisson began March 22. Work was commenced on the inner line of piers starting at bent 20, and carried toward the nearer end of the dock, the outer corresponding piers being placed as work progressed. By a modification in the original plan the oblique row of piers at this end of the dock was omitted. On the 1st of June, 1911, work was started on the nineteenth bent, and during the remainder of the month at bents 9, 10, 11, and 12. The holes for piers at bents 4, 5, and 6 were being prepared at the end of the month. When the caissons originally started have all reached rock, work on the flooring may be carried on here simultaneously with work on substructure at other portions of the dock.

The accompanying table shows rate of progress of sinking operations from the start of the first caisson to June 30, 1911.

The caissons are designated as in Plate 115. The numerals refer to the number of the bent and the letters to the position of the caissons in the bent, the letter "A" referring to the outside caisson of any bent, "B" to the one next inshore, and so on. Thus in bent 23, for example, the third caisson from the outside one is 23-C; the inside caisson in bent 24 is 24-D.

TABLE 20.—*Progress in sinking caissons.*

Caisson No.	Date of starting.	Date at rock.	Elevation of rock.	Rate of progress to June 30, 1911.		
				Penetration.	Hours at work.	Penetration per hour.
				<i>Feet.</i>		
20-B.....	Mar. 22, 1911	May 18	—60.25	49.62	147.00	0.337
22-B.....	Mar. 25, 1911			57.80	124.25	.465
21-B.....	Mar. 30, 1911	June 2	—61.00	50.80	117.50	.432
23-C.....	Apr. 1, 1911	June 24	—63.42	56.72	147.75	.384
24-D.....	Apr. 11, 1911			56.83	140.00	.406
24-C.....	Apr. 21, 1911			47.50	100.00	.475
20-A.....	Apr. 28, 1911	June 5	—60.83	59.85	102.00	.586
21-A.....	May 6, 1911	June 10	—61.67	60.92	129.00	.472
22-A.....	May 12, 1911			59.39	136.50	.435
23-A.....	May 23, 1911			47.83	125.00	.383
23-B.....	May 26, 1911			56.00	128.50	.436
24-B.....	June 2, 1911			45.34	115.00	.394
24-A.....	June 3, 1911			47.66	111.00	.429
19-A.....	June 7, 1911			36.17	82.00	.441
12-A.....	June 12, 1911			35.83	92.00	.389
11-A.....	June 13, 1911			43.75	99.00	.442
11-B.....	June 15, 1911			24.83	63.00	.394
10-B.....	June 17, 1911			39.59	84.00	.471
9-B.....	June 21, 1911			21.17	49.00	.432
12-B.....	June 29, 1911			5.17	15.00	.345
Total.....				902.77	2,107.50	
General average.....						.428

A small hole was dug by orange peel in each case at location of piers. As the ground is irregular, this accounts for varying "penetrations" when the rock is met with at nearly the same elevations; also for discrepancy between "Elevation of rock" and "Penetration" columns for any one pier. Labor based on 9-hour day in effect on Panama Railroad.

### THIRD DISTRICT.

#### MUNICIPAL AND SANITARY WORK.

[F. Cotton, assistant engineer.]

#### MUNICIPAL ENGINEERING.

This department operates and maintains certain permanent plants and makes all municipal improvements within the division, including the city of Panama. The permanent plants are the Ancon and Cocoli pumping and filtration stations and the Rio Grande and Cocoli reservoirs.

#### ANCON PUMPING AND FILTRATION STATION.

There were no changes made in this station, which is described in previous reports; it was maintained in good running order and the cost is shown in Table 21.

TABLE 21.—*Details of work and cost: Ancon pumping and filtration station.*

Months.	Water pumped.	Cost of pumping.				Water filtered.	Cost of filtering.			
		Labor.	Material.	Total.	Per 1,000 gallons.		Labor.	Material.	Total.	Per 1,000 gallons.
1910.	<i>Gallons.</i>					<i>Gallons.</i>				
July.....	10,121,000	\$428.11	\$684.84	\$1,112.95	\$0.1099	43,407,685	\$54.47	\$319.42	\$373.89	\$0.0086
August.....	11,100,000	288.36	585.72	874.08	.0788	46,991,642	75.13	375.84	450.97	.0096
September.....	11,140,000	241.30	563.10	804.40	.0722	45,977,500	54.61	251.21	305.82	.0066
October.....	12,884,000	406.77	821.80	1,228.57	.0953	47,530,267	76.51	506.06	642.57	.0135
November.....	12,888,000	492.90	759.19	1,252.09	.0972	47,024,717	64.10	193.37	257.47	.0055
December.....	13,640,000	361.29	777.13	1,138.42	.0834	51,199,455	82.27	622.48	704.75	.0137
1911.										
January.....	11,270,000	338.68	636.66	975.34	.0865	48,064,595	60.80	12.81	73.61	.0015
February.....	11,570,000	357.18	629.05	986.23	.0766	47,023,537	61.82	253.89	315.71	.0067
March.....	13,653,000	340.08	709.02	1,049.10	.0768	41,123,125	54.73	10.59	65.32	.0016
April.....	13,738,000	269.63	774.22	1,043.85	.0759	51,958,470	44.38	9.23	53.61	.0013
May.....	14,199,000	425.73	730.08	1,155.81	.0814	55,072,355	80.00	350.40	430.40	.0078
June.....	15,527,000	365.91	753.49	1,119.40	.0721	56,223,815	46.68	31.25	77.93	.0014
Total..	151,740,000	4,315.94	8,324.30	12,640.24	.0834	581,597,163	755.50	2,996.55	3,752.05	.0064

## COCOLI PUMPING AND FILTRATION STATION.

At the beginning of the calendar year 1910, the water consumption from Culebra south had increased to an extent that required supplementing the Rio Grande reservoir. Cocoli Lake was selected for this purpose, and a pumping and filtration station installed for treating the water and pumping it into the main leading from the Rio Grande reservoir. This station was described in the last annual report, but in order to maintain the required pressure at the extreme south end of the system it has been necessary during the present year to install an 8-inch motor-driven centrifugal pump to lift the water from the lake to the mixing tanks (a service previously performed by one of the 10-inch pumps referred to in the last report), and to use both of the 10-inch pumps for forcing the treated water through the mains. This change was made chiefly to satisfy the demand for an increase of pressure in the city of Panama. The cost of operation is given in Table 22.

TABLE 22.—*Details of work and cost: Cocoli pumping and filtration station.*

Months.	Water pumped.	Cost of pumping.				Water filtered.	Cost of filtering.			
		Labor.	Material.	Total.	Per 1,000 gallons.		Labor.	Material.	Total.	Per 1,000 gallons.
1910.	<i>Gallons.</i>					<i>Gallons.</i>				
July.....	17,204,000	\$319.48	\$2,250.99	\$2,570.47	\$0.1494	17,204,000	\$54.10	\$73.77	\$127.87	\$0.0074
August.....	19,076,000	298.65	2,266.81	2,565.46	.1345	19,076,000	44.74	.....	44.74	.0023
September.....	19,610,000	271.23	1,253.96	1,525.19	.0777	19,610,000	35.44	.....	35.44	.0018
October.....	21,353,000	205.40	1,894.26	2,099.66	.0983	21,353,000	43.29	11	43.40	.0020
November.....	23,043,000	394.47	1,239.20	1,633.67	.0709	23,043,000	48.03	8.36	56.39	.0024
December.....	22,893,000	412.28	1,621.65	2,033.93	.0888	22,893,000	58.91	8.74	67.65	.0029
1911.										
January.....	24,842,000	797.44	1,507.09	2,304.53	.0928	24,842,000	55.80	10.62	66.42	.0027
February.....	32,992,000	997.54	2,020.76	3,018.30	.0915	32,992,000	57.03	263.30	320.33	.0097
March.....	36,795,000	709.16	2,862.32	3,571.48	.0971	36,795,000	45.05	11.35	56.40	.0015
April.....	30,613,000	794.52	2,344.35	3,138.87	.1025	30,613,000	53.30	67.74	120.04	.0039
May.....	37,533,000	840.78	3,878.99	4,719.72	.1257	37,533,000	43.16	7.89	51.04	.0014
June.....	40,582,000	877.85	2,973.47	3,851.32	.0975	40,582,000	53.74	9.52	63.26	.0015
Total..	326,536,000	6,618.80	26,113.80	32,732.60	.1002	326,536,000	592.59	461.39	1,053.98	.0032

## RIO GRANDE AND COCOLI RESERVOIRS.

These reservoirs supply Culebra and all points south, including the city of Panama, with water for both domestic and construction purposes. The Cocoli supply enters the Rio Grande main at Miraflores. The demand has increased materially each year since the system was installed, as may be seen from the following statement:

TABLE 23.—*Water consumption from Culebra (included) south.*

Fiscal year—	Reservoirs.		Total.
	Rio Grande.	Cocoli.	
	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>
1905 <sup>1</sup> .....	No record.	.....	.....
1906 <sup>1</sup> .....	No record.	.....	.....
1907 <sup>2</sup> .....	No record.	.....	.....
1908.....	942,200,000	.....	942,200,000
1909.....	1,104,421,000	.....	1,104,421,000
1910.....	1,258,771,000	38,179,000	1,297,950,000
1911.....	1,410,057,000	327,733,000	1,737,790,000

<sup>1</sup> Water first turned into main to Ancon June 26, 1905, and into Panama July 4, 1905.

<sup>2</sup> Venturi meter installed January, 1907. No record of water consumption between date of installation of meter and July 1, 1907.

The Rio Grande is a permanent reservoir and has been maintained at a total cost of \$5,586.09 for the year, and furnished 1,410,057,000 gallons of water.

The Cocoli reservoir is a body of water formed by the partial construction of the west dam at Miraflores and is supplied by the Cocoli River; it will ultimately be a portion of the Miraflores Lake, and will be used as a reservoir during the construction period only. In February, 1911, it was discovered that salt water from the hydraulic fill of the Miraflores dam was leaking through the west toe into Cocoli Lake. This necessitated abandoning the use of this reservoir temporarily, but the leak had been stopped and a pump installed, with an intake near the bottom of the lake, for pumping out the heavy salt water, and this, together with the inflow of fresh water, has reduced the percentage of chlorine so that the water is usable, and it is expected that it will shortly be reduced to the normal percentage. The cost of maintaining this reservoir has been \$1,544.51, and 327,733,000 gallons of water were furnished during the year.

The following information regarding the reservoirs may be of value:

TABLE 24.—*Pacific division reservoirs.*

	Unit.	Rio Grande.	Cocoli.	Total.
Drainage area.....	Square mile.	3.15	17.00	20.15
Maximum lake area.....	Acre.....	72.77	129.51	202.28
Elevation of spillway with flashboards.....	Foot.....	238.17	43.00	.....
Maximum depth of water.....	do.....	52.67	33.00	.....
Total capacity.....	Gallon.....	490,667,000	798,700,000	1,289,367,000
Storage at lowest elevation, 1910-11.....	do.....	219,923,000	400,212,000	620,135,000
Average daily consumption, 1910-11.....	do.....	3,865,168	938,118	4,803,286
Average daily consumption, city of Panama.....	do.....	.....	.....	1,214,661

The total amount of water consumed during the year was 1,737,790,000 gallons, including 443,351,263 gallons used in the city

of Panama. A detailed statement of the consumption by districts is given in Table 25.

TABLE 25.—Consumption of water by districts, 1910–11.

Months.	Panama.	Ancon high service.	Tivoli section.	Balboa (6 and 10 inch mains).	Cucaracha pump.
1910.	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>
July.....	33,280,685	10,116,000	933,600	5,517,000	16,300,000
August.....	35,991,642	11,110,000	2,549,500	12,797,900	17,602,000
September.....	34,837,500	10,967,000	2,724,200	15,246,200	15,078,000
October.....	34,636,267	13,061,000	2,263,100	15,296,300	15,300,000
November.....	34,136,717	12,315,000	963,300	14,177,600	14,800,000
December.....	37,559,455	14,078,000	1,172,200	13,301,600	15,200,000
1911.					
January.....	36,794,595	11,228,000	1,426,100	12,095,200	15,150,000
February.....	35,400,637	11,919,000	1,576,400	12,445,000	14,850,000
March.....	41,023,125	13,601,000	1,569,400	10,934,000	15,128,000
April.....	38,220,470	13,626,000	1,505,500	11,578,400	15,100,000
May.....	40,873,355	14,366,000	1,116,000	14,760,600	14,951,000
June.....	40,696,815	15,301,000	1,080,000	12,790,800	15,231,000
Total.....	443,351,263	151,688,000	18,879,300	150,980,600	184,680,000

Months.	Pedro Miguel, Paraiso, Comacho, Miraflores, and Corozal.	Source of supply.		
		Rio Grande reservoir.	Coccol Lake.	Total.
1910.	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>
July.....	57,391,715	107,654,000	15,885,000	123,539,000
August.....	45,623,958	105,942,000	19,633,000	126,575,000
September.....	52,693,100	111,936,000	19,610,000	131,546,000
October.....	57,917,333	115,919,000	22,555,000	138,474,000
November.....	72,327,383	125,413,000	23,307,000	148,720,000
December.....	78,427,745	137,057,000	22,682,000	159,739,000
1911.				
January.....	82,660,105	133,480,000	25,874,000	159,354,000
February.....	67,822,963	111,525,000	32,499,000	144,014,000
March.....	73,810,475	119,439,000	36,627,000	156,066,000
April.....	72,421,630	120,449,000	32,003,000	152,452,000
May.....	69,255,045	117,546,000	37,766,000	155,312,000
June.....	57,969,385	103,697,000	39,302,000	142,969,000
Total.....	788,250,837	1,410,057,000	327,733,000	1,737,790,000

NOTE.—The consumption given for Pedro Miguel, Paraiso, Comacho, Miraflores, and Corozal is the difference between the total consumption of the various other districts (which are metered) and the total supply.

## PANAMA IMPROVEMENTS.

All municipal and sanitary improvements in the city of Panama are made by the commission and the cost repaid through the collection of water taxes, as provided in Article VII of the treaty between the United States and Republic of Panama. The work of improving the districts of Guachapali, Santa Cruz, Cocoa Grove, Ancon Boulevard, and Avenue B by grading and macadamizing the streets, laying concrete curbs and gutters, sewers, and water mains was completed during the year. In addition, La Neveria was graded and paved and an intercepting sewer laid to prevent the flooding of Central Avenue and adjacent property. A survey and plans were made for developing the district bounded by the Zone Line Road, B Street, Fourth of July Avenue, and West Sixteenth Street. The amount and cost of the work are shown in Table 26.

TABLE 26.—*New street improvements in the city of Panama, November, 1909, to June 30, 1911.*

Name of district and street.	Paving and curbing.		Sewer mains and laterals.						Water mains and laterals.			Total cost of streets.	Total cost of districts.	
	Street length.	Street width.	Cost.	Mains.		Laterals.		Cost.	Mains.	Laterals (½ inch).				
				Length.	Size.	Length.	Size.							
											Linear feet.			Inch.
COCOA GROVE.														\$17,477.94
West Seventeenth Street.....	840	18	\$1,244.27	600	8	139	6	\$108.33	368	4	\$223.33	\$1,875.93		
West Eighteenth Street.....	1,760	18	2,284.67	.....	.....	270	6	664.33	584	4	864.65	3,813.65		
West Nineteenth Street.....	1,553	18	2,100.22	.....	.....	192	6	111.82	485	4	240	807.26		
West Twentieth Street.....	1,667	18	2,658.70	.....	.....	264	6	1,059.70	823	4	304	1,127.86		
Sur Avenue.....	428	16	615.65	.....	.....	48	6	231.20	232	4	54	1,129.68		
San Vicente Street.....	1,750	18	2,287.68	.....	.....	160	6	173.37	27	4	157	2,753.12		
GUACHAPALI.														
Thirty-first Street.....	1,064	24	2,040.00	{	547	8	106	6	1,510.32	543	6	962.55	4,512.87	
Thirty-second Street.....	1,180	24	2,945.03	.....	253	8	188	6	879.74	613	6	1,083.75	4,918.52	
Thirty-third Street.....	1,168	24	2,996.96	.....	609	8	188	6	831.75	604	6	983.46	4,825.17	
Thirty-fourth Street.....	1,160	24	1,906.95	.....	600	8	227	6	807.44	600	6	931.92	3,649.31	
Thirty-fifth Street.....	1,134	24	2,161.73	.....	591	10	192	6	1,371.99	591	6	1,039.04	4,572.76	
Thirty-sixth Street.....	720	24	1,786.85	.....	336	8	174	6	940.45	385	6	707.11	3,437.41	
Istmo Street.....	3,538	{	8,826.04	{	1,392	8	282	6	2,389.34	1,640	8	696	2,597.70	13,813.06
Republica Street.....	1,941	24	4,553.62	{	1,137	10	304	6	2,336.54	1,137	6	841	1,890.11	8,770.27
Ossa Street.....	1,181	24	2,090.49	.....	578	8	144	6	842.13	578	6	377	916.39	3,849.01
Escobar Street.....	1,773	24	2,406.60	.....	591	10	176	6	820.37	591	6	419	954.93	4,181.90
Concordia Street.....	739	24	1,187.84	.....	347	8	120	6	440.37	377	6	348	596.30	2,224.51
Herobar Street.....	816	24	1,642.58	.....	430	10	132	6	510.90	440	6	362	673.97	2,827.45
Mueller Place.....	400	24	683.88	.....	.....	.....	.....	.....	.....	310	8	.....	460.10	1,143.98
AVENUE B.														
East Twentieth Street.....	740	16	1,125.72	.....	338	8	120	6	409.91	(1)	4	153	145.71	1,681.34
East Twenty-first Street.....	660	15	1,141.67	.....	300	8	104	6	338.69	300	6	104	427.95	1,911.31
East Twenty-second Street.....	550	16	1,171.16	.....	250	8	104	6	352.54	244	6	132	359.71	1,893.41
East Twenty-third Street.....	400	15	968.45	.....	175	8	104	6	271.29	170	6	59	282.92	1,462.66
Obarrin Place.....	920	18	1,798.26	.....	425	8	184	6	590.04	425	6	224	607.33	2,983.63
Lyon Street.....	1,018	18	1,586.87	.....	456	8	152	6	515.97	449	6	213	622.66	2,725.50

## SANTA CRUZ.

Thirty-seventh Street.....	670	18	1,394.45	342	8	88	6	497.92	342	6	253	657.79	2,480.16
Thirty-eighth Street.....	1,340	18	1,812.14	716	8	120	6	919.70	716	6	345	1,194.19	3,928.03
Thirty-ninth Street.....	752	18	1,196.98	388	8	96	6	492.06	388	6	276	731.84	2,422.90
Fortieth Street.....	988	18	1,366.76	498	8	112	6	598.15	498	6	222	774.39	2,730.30
Independencia Street.....	2,005	18	4,181.13	1,027	8	186	6	1,263.44	720	6	223	1,330.36	6,878.93
Constitucion Street.....	1,500	18	2,521.49	1,802	8	128	6	1,107.56	802	6	414	1,359.47	4,988.52
América Street.....	1,404	18	2,895.62	752	8	168	6	972.43	752	6	406	1,242.11	5,110.16
Perigault Street.....	586	18	948.12	367	8	96	6	380.46	368	6	222	590.93	1,920.51
Caledonia Street.....	32	.....	90.94	2,993	8	806	6	3,990.09	3,063	6	1,347	4,879.94	8,900.97
Caledonia Road; Caledonia Road extension, etc.....	2,220	.....	4,905.92	.....	.....	.....	.....	.....	.....	.....	.....	.....	39,419.48
Ancon Boulevard.....	1,909	20	2,969.45	745	8	448	6	1,707.91	1,172	6	552	1,633.41	4,905.92
Jose Hignito.....	572	16	810.35	307	8	98	6	399.70	15	4	128	116.04	6,400.77
La Neveria.....	984	.....	1,438.17	450	8	136	6	430.05	444	6	368	340.07	1,326.09
30-inch concrete-pipe drain.....	702	.....	.....	702	30	.....	.....	2,603.94	.....	.....	.....	.....	2,209.29
Intercepting sewer.....	.....	.....	.....	2,461	.....	.....	.....	21,539.30	.....	.....	.....	.....	2,603.94
Total division cost.....	.....	.....	80,687.41	.....	.....	.....	.....	55,387.26	.....	.....	.....	34,982.15	171,256.82
Administrative and general expense.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,254.07
Total cost.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	189,510.89

1 Changing line.

NOTE.—Expenditures, included in the above table, during the fiscal year 1910-11, amounted to \$54,780.



## ZONE WATERWORKS.

The water mains were maintained and patrolled and all necessary house connections and fire hydrants installed. The water main leading to Balboa was moved to the north side of Sosa Hill to admit the raising of the Balboa dumps. A 6-inch motor-driven pump was set up at Pedro Miguel for the purpose of supplying the railroad tank and shops with water from the Pedro Miguel River, thus relieving the regular water system of approximately 800,000 gallons a day.

The 16-inch main from the Rio Grande Reservoir crosses the Culebra Cut near the south end. It has been necessary to shift this crossing during the year to permit the excavation of a drainage channel in the cut. The permanent crossing will be through a 24-inch pipe embedded in the emergency dam sill of the Pedro Miguel locks, and the final movement of the main to its permanent location will probably be made in about three months.

The 10,000-gallon reenforced concrete reservoir at Palo Seco Leper Asylum was completed in July, 1910, and a distributing system constructed.

TABLE 27.—*Cost of maintenance and repairs, Zone waterworks.*

Description.	Labor.	Material.	Total.
Rio Grande Reservoir.....	\$1,979.12	\$115.44	\$2,094.56
Rio Grande Reservoir (clearing slopes).....	1,684.74		1,684.74
Pedro Miguel district.....	1,521.60	183.39	1,704.99
Miraflores district.....	3,019.33	363.91	3,383.24
Corozal district.....	85.10	10.26	95.36
Ancon district.....	1,763.94	212.61	1,976.55
Balboa district.....	609.29	73.44	682.73
East Balboa district.....	168.39	20.30	188.69
Total.....	10,831.51	979.35	11,810.86

A detailed statement of the construction work performed during the year is given in Table 28.

TABLE 28.—*Zone waterworks construction—Statement of work performed during year ended June 30, 1911.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>PEDRO MIGUEL DISTRICT.</b>					
Connection to house of Lee On & Co.:					
Excavation.....	6 cubic yards.....	\$3.00		\$3.00	\$0.50
Back fill.....	do.....	1.60		1.60	.27
Laying 1-inch pipe.....	230 linear feet.....	4.49	\$6.06	10.55	.06
Total.....		9.09	6.06	15.15	
Connection to locomotive standpipe:					
Excavation.....	47 cubic yards.....	20.73		20.73	.44
Handling material.....		7.13		7.13	
Back fill.....	5 cubic yards.....	.80		.80	.16
Laying 3-inch galvanized-iron pipe.....	445 linear feet.....	36.36	114.56	150.92	.34
Total.....		65.02	114.56	179.58	
Connection to house of D. E. Caldenhead:					
Making tap.....		1.14		1.14	
Laying 1-inch galvanized-iron pipe.....	697 linear feet.....	10.44	35.55	45.99	.015
Total.....		11.58	35.55	47.13	

TABLE 28.—Zone waterworks construction—Statement of work performed during year ended June 30, 1911—Continued.

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>PEDRO MIGUEL DISTRICT—continued.</b>					
<b>Installing 4-inch main and erecting water trough:</b>					
Excavation.....	35 cubic yards.....	\$13.84		\$13.84	\$0.39
Back fill.....	do.....	5.80		5.80	.17
Handling material.....		12.86		12.86	
Laying 4-inch cast-iron pipe.....	196 linear feet.....	38.33		38.33	.20
Building trough and repairing spring.....		32.70	\$82.29	114.99	
Total.....		103.53	82.29	185.82	
<b>Connections to houses Nos. 54 and 55:</b>					
Excavation.....	8 cubic yards.....	3.09		3.09	.46
Handling material.....		1.72		1.72	
Making connections.....		1.08	1.10	2.18	
Back fill.....	8 cubic yards.....	1.60		1.60	.20
Total.....		8.09	1.10	9.19	
<b>Connection to colored school:</b>					
Excavation.....	5 cubic yards.....	3.00		3.00	.60
Back fill.....	do.....	.75		.75	.15
Laying 4-inch galvanized-iron pipe.....	144 linear feet.....	5.40	4.27	9.67	.061
Total.....		9.15	4.27	13.42	
<b>Relaying water main to European mess:</b>					
Excavation.....	14 cubic yards.....	12.60		12.60	.90
Laying 24-inch water line.....	20 linear feet.....				
Laying 14-inch water line.....	12 linear feet.....	10.30		10.30	.33
Laying 6-inch vitrified pipe.....	6 linear feet.....	.72		.72	.12
Total.....		23.62		23.62	
<b>Changing location of 16-inch main:</b>					
Excavation.....	930 cubic yards.....	940.00		940.00	1.01
Handling material.....		398.00		398.00	
Laying pipe.....	1,100 linear feet.....	650.00	281.62	931.62	.85
Back fill.....	930 cubic yards.....	120.00		120.00	.13
Installing tee.....		48.60		48.60	
Making connection.....		185.30		185.30	
Reclaiming old pipe.....	652 linear feet.....	327.12		327.12	.50
Total.....		2,669.52	281.62	2,951.14	
<b>Connection to house of Charles Henry:</b>					
Excavation.....	1 cubic yard.....	.76		.76	.76
Laying 1-inch galvanized-iron pipe.....	438 linear feet.....	6.90	24.86	31.76	.07
Total.....		7.66	24.86	32.52	
<b>Installation of tee in 16-inch main:</b>					
Handling material.....		16.64		16.64	
Removing valve and 16-inch pipe.....		39.24		39.24	
Excavation.....	24 cubic yards.....	22.36		22.36	.93
Back filling and tamping.....	45 cubic yards.....	21.87		21.87	.48
Installing tee.....		63.18	1.99	65.17	
Total.....		163.29	1.99	165.28	
<b>Laying new 24-inch main across forebay, Pedro Miguel:</b>					
Handling material.....	{ 2 24-inch bends.....	10.16		10.16	
Laying pipe.....	{ 2 45-inch bends.....	221.72	2,654.36	2,876.08	
	156 linear feet.....				
Total.....		231.88	2,654.36	2,886.24	
<b>Miscellaneous: Installing 6-inch motor-driven centrifugal pump.</b>					
		1,293.37	1,715.89	3,009.26	
Total, Pedro Miguel district.....		4,595.70	4,922.55	9,518.25	

TABLE 28.—*Zone waterworks construction—Statement of work performed during year ended June 30, 1911—Continued.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>MIRAFLORES DISTRICT.</b>					
Installing water system, Miraflores locks:					
Excavation.....	291 cubic yards.....	\$296.63		\$296.63	\$1.02
Back fill.....	do.....	40.58		40.58	.14
Laying 7-inch black-iron pipe.....	491 linear feet.....	104.82	\$284.85	389.67	.80
Laying 5-inch galvanized-iron pipe.....	3,311 linear feet.....	273.45	742.96	1,016.41	.31
Laying 3-inch galvanized-iron pipe.....	1,690 linear feet.....	194.40	528.18	722.58	.43
Handling material.....		119.62		119.62	
Reclaiming 3-inch galvanized-iron pipe.....	1,920 linear feet.....	246.58		246.58	.13
Connection to 16-inch main.....		58.63		58.63	
Total.....		1,334.71	1,555.99	2,890.70	
Installing 3-inch main to hydraulic plant:					
Excavation.....	78 cubic yards.....	62.40		62.40	.80
Laying 3-inch galvanized-iron pipe.....	2,015 linear feet.....	152.66	453.49	606.15	.30
Handling material.....		51.60		51.60	
Total.....		266.66	453.49	720.15	
Installing 10-inch black-iron water line:					
Excavation.....	81 cubic yards.....	101.50		101.50	1.25
Handling material.....		65.96		65.96	
Laying 10-inch black-iron pipe and installing 12-inch centrifugal pump.....	4,700 linear feet.....	1,826.94	5,626.76	7,453.70	1.58
Total.....		1,994.40	5,626.76	7,621.16	
Installing 4-inch galvanized-iron pipe line to fuel oil tanks:					
Excavation.....	22 cubic yards.....	9.16		9.16	.42
Cleaning brush.....		4.56		4.56	
Laying 4-inch galvanized-iron pipe (material taken from old line).....	900 linear feet.....	115.56	.46	116.02	.13
Total.....		129.28	.46	129.74	
Installing 34-inch fire connection to Panama Railroad trestle:					
Excavation.....	3 cubic yards.....	2.90		2.90	.97
Making connection.....		13.11	5.04	18.15	
Total.....		16.01	5.04	21.05	
Erecting locomotive standpipe at Cocoli:					
Laying 5-inch galvanized-iron pipe.....	800 linear feet.....	65.60	364.64	430.24	.54
Cutting brush.....		5.93		5.93	
Handling material.....		20.79		20.79	
Erecting locomotive standpipe.....		89.84		89.84	
Total.....		182.16	364.64	546.80	
Miscellaneous:					
Installing temporary 12-inch pump.....		537.32	405.77	943.09	
Installing 8-inch motor-driven centrifugal pump.....		842.42	2,165.85	3,008.27	
Total, Miraflores district.....		5,302.96	10,578.00	15,880.96	
<b>COROZAL DISTRICT.</b>					
Connection to house No. 20:					
Excavation.....	8 cubic yards.....	4.26		4.26	.53
Laying 1-inch galvanized-iron pipe.....	80 linear feet.....	5.04	.95	5.99	.07
Total.....		9.30	.95	10.25	
Connection to Panama R. R. labor cars:					
Laying 3-inch galvanized-iron pipe.....	200 linear feet.....	6.15	1.13	7.28	.03
Laying 1-inch galvanized-iron pipe.....	40 linear feet.....				
Total.....		6.15	1.13	7.28	
Connection to house No. 35:					
Excavation.....	4 cubic yards.....	2.27		2.27	.57
Back fill.....	do.....	1.20		1.20	.30
Laying 1-inch galvanized-iron pipe.....	77 linear feet.....	5.56	.86	6.42	.08
Total.....		9.03	.86	9.89	

TABLE 28.—Zone waterworks construction—Statement of work performed during year ended June 30, 1911—Continued.

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>COROZAL DISTRICT—continued.</b>					
Connections to houses Nos. 32 and 33:					
Excavation.....	1 cubic yard.....	\$0.62	.....	\$0.62	\$0.62
Laying 1-inch galvanized-iron pipe...	210 linear feet.....	7.46	\$4.10	11.56	.05
Total.....		8.08	4.10	12.18	.....
Installing fire hydrant:					
Excavation.....	1 cubic yard.....	.80	.....	.80	.80
Erecting hydrant.....		13.48	2.51	15.99	.....
Total.....		14.28	2.51	16.79	.....
Total, Corozal district.....		46.84	9.55	56.39	.....
<b>ANCON DISTRICT.</b>					
Connection to house No. 189: Laying $\frac{1}{2}$ -inch galvanized-iron pipe.	60 linear feet.....	1.75	.16	1.91	.03
Connection to washstand, Ancon Corral:					
Excavation.....	6 cubic yards.....	4.44	.....	4.44	.74
Back fill.....	do.....	1.96	.....	1.96	.33
Making connection.....		2.27	1.91	4.18	.....
Total.....		8.67	1.91	10.58	.....
Connections to houses 161-162-228:					
Excavation.....	3 cubic yards.....	2.25	.....	2.25	.75
Laying $\frac{1}{2}$ -inch galvanized-iron pipe...	80 linear feet.....	3.60	.16	3.76	.05
Total.....		5.85	.16	6.01	.....
Connection of Panama main with high-pressure reservoir:					
Excavation.....	392 cubic yards.....	283.48	.....	283.48	.71
Back fill.....	do.....	180.82	.....	180.82	.41
Handling material.....		348.15	.....	348.15	.....
Laying 10-inch galvanized-iron pipe.....	1,850 linear feet.....	428.76	3,005.40	3,434.25	1.85
Making connections.....		144.20	.....	144.20	.....
Miscellaneous.....		84.48	.....	84.48	.....
Total.....		1,440.89	3,005.40	4,455.38	.....
Total, Ancon district.....		1,466.16	3,007.72	4,473.88	.....
<b>BALBOA DISTRICT.</b>					
Connecting 60,000-gallon tank with 8-inch main:					
Excavation.....	11 cubic yards.....	7.36	.....	7.36	.67
Laying $2\frac{1}{2}$ -inch galvanized-iron pipe.....	120 linear feet.....	18.21	31.01	49.22	.40
Total.....		25.57	31.01	56.58	.....
Connection to Catholic Church:					
Excavation.....	2 cubic yards.....	2.03	.....	2.03	1.01
Laying $\frac{1}{2}$ -inch galvanized-iron pipe...	100 linear feet.....	1.72	3.20	4.92	.05
Total.....		3.75	3.20	6.95	.....
Connection to Panama R. R. labor cars.....		1.99	.58	2.57	.....
Connections for houses of E. G. Perrott.....		8.26	2.26	10.52	.....
Installing water line to house No. 62:					
Excavation.....	6 cubic yards.....	4.33	.....	4.33	.72
Back fill.....	do.....	1.99	.....	1.99	.33
Laying $\frac{1}{2}$ -inch galvanized-iron pipe.....	56 linear feet.....	1.55	3.48	5.03	.09
Making tap.....		1.35	.....	1.35	.....
Total.....		9.22	3.48	12.70	.....
Changing location of 8-inch water main:					
Excavation.....	673 cubic yards.....	559.73	.....	559.73	.83
Back fill.....	482 cubic yards.....	255.93	.....	255.93	.53
Handling material.....		190.28	.....	190.28	.....
Laying 8-inch cast-iron pipe.....	2,067 linear feet.....	404.65	1,759.52	2,164.17	1.04

TABLE 28.—*Zone waterworks construction—Statement of work performed during year ended June 30, 1911—Continued.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>BALBOA DISTRICT—continued.</b>					
Changing location of 8-inch water main—Continued.					
Cutting brush.....		\$40. 41		\$40. 41	.....
Miscellaneous.....		164. 70		164. 70	.....
Total.....		1, 615. 70	\$1, 769. 52	3, 375. 22	.....
Installing water tap, California-Atlantic Steamship Co.		6. 66	. 16	6. 82	.....
Total, Balboa district.....		1, 671. 15	1, 800. 21	3, 471. 36	.....
<b>MISCELLANEOUS.</b>					
Palo Seco water system.....		1, 103. 28	962. 85	2, 066. 13	.....
Installing No. 2 barge pump, Miraflores.....		1, 025. 18	564. 35	1, 589. 53	.....
Moving Calmitillo line to lock site.....		123. 19	32. 31	155. 50	.....
Concrete spillway dam, Cocoi Lake.....		1, 347. 21	800. 41	2, 147. 62	.....
Total.....		3, 598. 86	2, 359. 92	5, 958. 78	.....

## RECAPITULATION.

	Labor.	Material.	Total.
Pedro Miguel district.....	\$4, 595. 70	\$4, 922. 55	\$9, 518. 25
Miraflores district.....	5, 302. 96	10, 578. 00	15, 880. 96
Corozal district.....	46. 84	9. 55	56. 39
Ancon district.....	1, 466. 16	3, 007. 72	4, 473. 88
Balboa district.....	1, 671. 15	1, 800. 21	3, 471. 36
Miscellaneous.....	3, 598. 86	2, 359. 92	5, 958. 78
Total.....	16, 681. 67	22, 677. 95	39, 359. 62

## ZONE SEWERAGE SYSTEM.

Aside from completing the sewerage system at Palo Seco, all work performed during the year consisted in making repairs, extensions, and house connections. Details are given in Table 29.

TABLE 29.—*Statement of work performed on sewers during fiscal year ended June 30, 1911.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>PEDRO MIGUEL DISTRICT.</b>					
Connections to Italian camp:					
Laying pipe.....	900 linear feet 8-inch vitrified pipe.	\$55. 70	\$163. 28	\$218. 98	\$0. 2433
Excavation.....	311 cubic yards.....	323. 69		323. 69	1. 0408
Back fill.....	311 cubic yards.....	124. 33		124. 33	. 3998
Manholes.....	42. 60	42. 60		42. 60	
Handling material.....		85. 82		85. 82	
Total.....		632. 14	163. 28	795. 42	.....
Connections to houses Nos. 54 and 55:					
Laying pipe.....	112 linear feet 6-inch vitrified pipe.	11. 20	10. 94	22. 14	. 1968
Excavation.....	51 cubic yards.....	45. 61		45. 61	. 8943
Back fill.....	51 cubic yards.....	10. 20		10. 20	. 2000
Handling material.....		10. 60		10. 60	
Manholes.....		29. 40		29. 40	
Cutting through culvert.....		7. 85		7. 85	
Total.....		114. 86	10. 94	125. 80	.....

TABLE 29.—Statement of work performed on sewers during fiscal year ended June 30, 1911—Continued.

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>PEDRO MIGUEL DISTRICT—contd.</b>					
Connection to house No. 40:					
Laying pipe.....	20 linear feet 6-inch vitrified pipe.	\$3.30	\$0.26	\$3.56	\$0.1737
Excavation.....	5 cubic yards.	3.00		3.00	.6000
Back fill.....	5 cubic yards.	1.98		1.98	.3960
Total.....		8.28	.26	8.54	
Connection to colored school:					
Laying pipe.....	144 linear feet 6-inch vitrified pipe.	4.73	38.29	43.02	.2977
Excavation.....	85 cubic yards.	39.00		39.00	.4588
Back fill.....	85 cubic yards.	12.75		12.75	.1500
Total.....		56.48	38.29	94.77	
Total, Pedro Miguel district.		811.76	212.77	1,024.53	
<b>COROZAL DISTRICT.</b>					
Connections to house No. 20.....	12 feet 6-inch vitrified pipe..	6.85	1.23	8.08	.6464
Connections to house No. 35:					
Laying pipe.....	18 linear feet 6-inch vitrified pipe.	1.81	.86	2.67	.1443
Excavation.....	4 cubic yards.	2.27		2.27	.5675
Back fill.....	4 cubic yards.	1.20		1.20	.3000
Handling material.....		1.60		1.60	
Total.....		6.88	.86	7.74	
Connections to houses Nos. 32 and 33:					
Laying pipe.....	265 linear feet 6-inch vitrified pipe.	19.40	23.00	42.40	.1597
Excavation.....	72 cubic yards.	48.05		48.05	.6674
Back fill.....	72 cubic yards.	14.40		14.40	.2000
Handling material.....		6.04		6.04	
Connection to manhole.....		11.15		11.15	
Total.....		99.04	23.00	122.04	
Connection to Y. M. C. A.:					
Laying pipe.....	9 linear feet 6-inch vitrified pipe.	1.08	.09	1.17	.1271
Excavation.....	4 cubic yards.	3.20		3.20	.8000
Back fill.....	4 cubic yards.	.80		.80	.2000
Total.....		5.08	.09	5.17	
Connection to dentist's office:					
Laying pipe.....	12 linear feet 6-inch vitrified pipe.	10.83	4.74	15.57	1.246
Excavation.....	5 cubic yards.	4.10		4.10	.8200
Back fill.....	5 cubic yards.	1.05		1.05	.2100
Handling material.....		2.30		2.30	
Total.....		18.28	4.74	23.02	
Total, Corozal district.		136.13	29.92	166.05	
<b>ANCON DISTRICT.</b>					
Connection to cow barn:					
Laying pipe.....	30 linear feet 6-inch vitrified pipe.	2.96		2.96	.0970
Excavation.....	7 cubic yards.	6.89		6.89	.9843
Back fill.....	7 cubic yards.	2.55		2.55	.3643
Total.....		12.40		12.40	
Connection to house No. 189:					
Laying pipe.....	21 linear feet 6-inch vitrified pipe.	1.20		1.20	.0558
Excavation.....	5 cubic yards.	3.75		3.75	.7500
Back fill.....	5 cubic yards.	.94		.94	.1890
Total.....		5.89		5.89	

TABLE 29.—*Statement of work performed on sewers during fiscal year ended June 30, 1911—Continued.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
<b>ANCON DISTRICT—continued.</b>					
Connection to house of Pedro Arias: Laying pipe and connections....	7 and 12-foot 6-inch vitrified pipe.	\$0. 47	\$4. 37	\$4. 84	\$0. 3872
Excavation.....	3 cubic yards.....	2. 52	.....	2. 52	. 8733
Back fill.....	3 cubic yards.....	. 92	.....	. 92	. 3066
Total.....	.....	3. 91	4. 37	8. 28	.....
Connections to houses Nos. 161, 162, and 228: Laying pipe.....	30 linear feet 6-inch vitrified pipe.	2. 88	.....	2. 88	. 0944
Excavation.....	4 cubic yards.....	3. 00	.....	3. 00	. 7500
Back fill.....	4 cubic yards.....	1. 20	.....	1. 20	. 3000
Handling material.....	.....	1. 08	.....	1. 08	.....
Total.....	.....	8. 16	.....	8. 16	.....
Total, Ancon district.....	.....	30. 36	4. 37	34. 73	.....

## RECAPITULATION.

	Labor.	Material.	Total.
Pedro Miguel district.....	\$811. 76	\$212. 77	\$1,024. 53
Corozal district.....	136. 13	29. 92	166. 05
Ancon district.....	30. 36	4. 37	34. 73
Grand total.....	978. 25	247. 06	1,225. 31

*Zone sewer maintenance.*

Location.	Labor.	Material.	Total.
Pedro Miguel district.....	\$704. 89	\$184. 11	\$889. 00
Miraflores district.....	61. 28	18. 64	79. 92
Corozal district.....	119. 80	32. 19	151. 99
Ancon district.....	346. 63	93. 27	439. 90
Balboa district.....	161. 96	51. 21	213. 17
Falo Seco.....	124. 06	302. 80	426. 85
Total.....	1,518. 61	682. 22	2,200. 83

## ZONE ROADS.

The main highway parallel to the canal was completed from Pedro Miguel to the city of Panama by the the construction of 3.14 miles of road between Pedro Miguel and Corozal. This, in connection with the roads built by the central division, opens communication between the city of Panama and Gorgona, a distance of 20 miles. The Tumba Muerta road, 7,035 feet in length, was graded and widened for a distance of 5,535 feet, but not macadamized. A number of minor extensions were made in the roads of the various towns, and all existing roads, including that to the Sabanas, were repaired and maintained in good condition.

TABLE 30.—*Maintenance and repairs, Canal Zone roadways.*

	Length.	Labor.	Material.	Total.
	<i>Feet.</i>			
Pedro Miguel district.....		\$566.84	\$447.78	\$1,014.62
Corozal district.....		169.30	133.74	303.04
Ancon district.....		593.08	468.51	1,061.59
Balboa district.....		494.22	183.51	677.73
Ancon Hospital roads.....	2,100	743.07	1,024.15	1,767.22
Sabanas Road.....		145.20	62.98	208.18
Balboa Road.....	200	86.86	115.11	201.97
Tivoli Roads.....	1,680	797.51	1,303.09	2,100.60
Ancon Corral Road.....	850	233.84	242.57	476.41
Panama-Corozal road (screenings placed and rolled).....	17,100	363.91	69.09	433.00
Total.....		4,193.83	4,060.53	8,244.36

A detailed statement of new roads constructed is shown in Table 31.

TABLE 31.—*Work performed on Canal Zone roads during fiscal year ended June 30, 1911.*

Location.	Length.	Width.		Division cost.			Cost per linear foot.
		Road bed.	Macadam.	Labor.	Material.	Total.	
	<i>Lin. feet.</i>	<i>Feet.</i>	<i>Feet.</i>				
Tumba Muerta Road (convict labor).....	5,535	15		\$155.66	\$220.04	\$375.70	.....
Pedro Miguel dirt road and suspension bridge.....	700	12		175.28	305.47	480.75	\$0.6868
Pedro Miguel relocated road.....	1,754	18	14	1,190.41	846.72	2,037.13	1.16
Miraflores—10-foot road to laborers' camp.....	1,160	10	8	624.66	324.82	949.48	.8185
Corozal-Pedro Miguel road.....	16,603	18	14	11,911.02	22,069.74	33,970.76	2.05
Total.....				14,067.03	23,766.79	37,813.82	.....

## MISCELLANEOUS.

A crude suspension footbridge was built across the Pedro Miguel River for the accommodation of the native inhabitants of the district east of Pedro Miguel.

The 10,000-gallon reinforced concrete reservoir for Palo Seco was completed, and a reinforced concrete highway bridge built over the Cardenas River. The cost of the Cardenas River bridge is given in detail in Table 32, and of other miscellaneous work performed during the year in Table 33.

TABLE 32.—*Cost of reinforced concrete bridge, Cardenas River.*

	Concrete placed.	Labor.	Material.	Total.
	<i>Cubic yds.</i>			
Excavation.....		\$198.43	\$64.53	\$262.95
Forming.....		556.93	313.51	870.44
Reinforcing steel.....		50.32	156.57	206.89
Placing concrete.....	120	219.55	467.24	686.79
Teams, hauling, etc.....		202.30	241.27	443.57
Division charges.....				227.06
Total.....	120	1,227.53	1,243.11	2,717.70



TABLE 33.—*Miscellaneous municipal work, 1910-11.*

Description.	Labor.	Material.	Total.
General surveys.....	\$483.64		\$2,483.64
Installation of boiler, Tivoli Hotel.....	51.72	\$8.64	60.36
Washing out boiler:			
Tivoli Hotel.....	70.48	11.95	82.43
Ancon Hotel.....	77.22		77.22
Corozal Hotel.....	61.53	9.00	70.53
Construction of two streets in Cocoa Grove district, city of Panama, for Panama Real Estate Co.....	1,844.02	2,175.00	4,019.02
Total.....	2,588.61	2,204.59	4,793.20

## SANITARY WORK.

This work consisted of digging and cleaning ditches, laying concrete and tile drains, filling swamp lands, and other work of similar character, by the request of and in accordance with plans proposed by the sanitary department. The work executed is detailed in Table 34.

TABLE 34.—*Statement of sanitary work performed.*

Class of work and location.	Quantities of work performed.	Division cost.			Unit cost.
		Labor.	Material.	Total.	
<b>Cleaning earth drains:</b>	<i>Linear feet.</i>				
Pedro Miguel.....	71,784	\$4,432.87	\$3.76	\$4,436.63	\$0.062
Miraflores.....	71,408	3,347.64	33.52	3,381.16	.047
Corozal.....	133,212	2,971.87	8.11	2,979.98	.022
Ancon.....	144,146	1,953.75	82.99	2,036.74	.014
Balboa.....	90,460	1,379.97		1,379.97	.015
Total.....	511,010	14,086.10	128.38	14,214.48	.027
<b>Excavating new earth drains:</b>	<i>Cubic yards.</i>				
Pedro Miguel.....	12	14.23		14.23	1.180
Miraflores.....	175	175.28		175.28	1.020
Corozal.....	1,746	1,385.25	8.45	1,393.70	.800
Ancon.....	734	384.32	89.97	474.29	.650
Balboa.....	590	288.94		288.94	.490
Total.....	3,257	2,248.02	98.42	2,346.44	.720
<b>Sweeping cement drains:</b>	<i>Linear feet.</i>				
Ancon.....	281,498	267.42	42.13	309.55	.0011
East Balboa.....	25,063	17.74		17.74	.0007
Balboa.....	124,039	131.36	7.86	139.22	.0011
Total.....	430,600	416.52	49.99	466.51	.0010
<b>Filling swamps and holes:</b>	<i>Cubic yards.</i>				
Pedro Miguel.....	580	154.10		154.10	.27
Miraflores.....	236	205.84		205.84	.87
Ancon.....	22	14.05		14.05	.64
Balboa.....	225	122.74	3.89	126.63	.56
Total.....	1,063	496.73	3.89	500.62	.47
<b>Constructing cement drains:</b>	<i>Linear feet.</i>				
Pedro Miguel.....	3,923	1,199.10	694.96	1,894.06	.49
Ancon.....	1,573	1,207.07	437.81	1,644.88	1.04
Balboa.....	640	469.66	50.37	520.03	.81
Total.....	6,136	2,875.83	1,183.14	4,058.97	.66
<b>Laying tile drains:</b>					
Ancon.....	1,109	830.35	159.62	989.97	.89
Balboa.....	1,400	795.09	299.21	1,094.30	.78
Total.....	2,509	1,625.44	458.83	2,084.27	.83
<b>Miscellaneous:</b>	<i>Cubic yards.</i>				
Repairing cement drains.....		329.09	101.50	430.59	
Repairing tile drains.....		111.18	12.87	124.05	
Draining swamp—Panama.....		512.34	404.77	917.11	
Cut through Sosa Dam.....	1,696	915.34	12.78	928.12	.55
Install new pipe near Balboa Wharf.....		106.89	191.99	298.88	
Total.....		1,974.84	723.91	2,698.75	

TABLE 34.—Statement of sanitary work performed—Continued.

## RECAPITULATION.

Class of work.	Labor.	Material.	Total.
Cleaning earth drains.....	\$14,086.10	\$128.38	\$14,214.48
Excavating new earth drains.....	2,248.02	98.42	2,346.44
Sweeping cement drains.....	416.52	49.99	466.51
Filling swamps and holes.....	496.73	3.89	500.62
Constructing cement drains.....	2,875.83	1,183.14	4,058.97
Laying tile drains.....	1,625.44	458.83	2,084.27
Miscellaneous.....	1,974.84	723.91	2,698.75
Grand total.....	23,723.48	2,646.56	26,370.04

## FOURTH DISTRICT.

## ANCON QUARRY AND CRUSHERS.

[J. A. Loulan, superintendent.]

This plant has been in operation throughout the year excepting for several days lost while replacing the main shaft of the sledging crusher. A dust screen was added during the year, as it was found necessary to exclude the dirt contained in the seams of the quarry from the crusher product. The performance of the plant is shown in Table 35.

TABLE 35.—Performance of Ancon quarry and crushers.

Months.	Number of 8-hour days.	Average number of shovels.	Material excavated.			Crushed and supplied.				
			Large rock.	Strip-ped.	Quar-ried.	Locks.	Municipal department.	Other Pacific division work.	Other divisions, departments, etc.	Total.
1910.			<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
July.....	25	3. 12	6, 570	19, 515	43, 230	36, 510	2, 460	4, 185	75	43, 230
August.....	27	2. 62	2, 720	1, 153	61, 092	57, 235	2, 620	1, 265	72	61, 092
September.....	22	2. 00	225	4, 786	58, 244	55, 135	1, 505	840	764	58, 244
October.....	26	2. 12	2, 550	12, 487	92, 065	88, 304	3, 106	55	600	92, 065
November.....	25	3. 36	3, 694	18, 575	64, 130	62, 862	693	315	260	64, 130
December.....	26	4. 12	10, 105	16, 747	79, 699	78, 231	192	311	965	79, 699
1911.										
January.....	25	4. 76	12, 840	19, 820	73, 329	69, 866	2, 351	252	860	73, 329
February.....	23	5. 91	29, 911	16, 996	68, 293	62, 038	3, 030	706	2, 519	68, 293
March.....	27	5. 00	75	53, 594	87, 921	86, 450	218	640	613	87, 921
April.....	24	3. 15	.....	58, 839	73, 279	66, 885	153	1, 904	4, 337	73, 279
May.....	26	2. 88	2, 491	30, 807	73, 893	68, 194	187	5, 412	100	73, 893
June.....	26	2. 50	5, 230	6, 678	80, 649	77, 057	90	2, 992	510	80, 649
Total...	302	3. 66	76, 411	259, 997	855, 824	808, 767	16, 505	18, 877	11, 675	855, 824

A total of 76,411 cubic yards of large rock, not passed through the crushers, was excavated for backfilling the lock walls and other purposes.

The following drilling was done:

Drilling with power drills.....	linear feet..	71,197
Drilling with hand drills.....	do....	None.
Total.....		71,197

*Explosives used.*

Dynamite.....	gross tons..	69.05
Black powder.....	do....	12.57
Total.....		81.62

## FIFTH DISTRICT.

## HYDRAULIC EXCAVATION.

[W. L. Thompson, assistant engineer.]

The hydraulic excavating plant, described in the last annual report, began operation in the lower lock at Miraflores during the latter part of September, 1910, and completed its work in the lock site in February, 1911. The dredging units were then moved south into the sea-level section of the canal where they are now operating. The plant has excavated both earth and rock, the latter requiring blasting, and deposited the same either in the west dam or on the swamp land east of the lock site at a total average cost of \$0.611 per cubic yard in place. While the cost so far has been greater than originally anticipated, it is materially less than similar work performed by steam shovels in the lock site, and is also less than the average combined cost of dredging equivalent amounts of earth and rock. The main difficulty has been to sink the dredging barges as proposed at the outset, as numerous bowlders and sunken logs were encountered, and rock requiring blasting was found at a higher elevation than indicated by the borings; these not only prevented the barges from settling but injured their bottoms, thus necessitating frequent shut-downs for repairs. For this reason it has been considered economical to abandon the barges and place the dredging pumps at intervals along the axis of the proposed channel, with their suctions in sumps that extend slightly below the final grade. Two pumps have been installed in the above manner; the third is still operating from a barge, but will be moved as soon as the sump is prepared.

TABLE 36.—*Hydraulic plant excavation.*

Month.	Excavated.			Deposited.	
	Lock.	Prism.	Total.	Dam.	Swamp.
1910.	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
July.....					
August.....					
September.....					
October.....	40,000		40,000	40,000	
November.....	47,444		47,444	47,444	
December.....	68,681		68,681	68,681	
1911.					
January.....	89,243		89,243	89,243	
February.....	87,335		87,335	87,335	
March.....		91,957	91,957	25,131	66,826
April.....		33,509	33,509	14,100	19,409
May.....		18,353	18,353	18,353	
June.....		53,858	53,858	53,858	
Total.....	332,703	197,677	530,380	444,145	86,235

## SURVEYS, MAPS, AND OFFICE WORK.

## SURVEYS.

At the request of the Panaman Government, surveys and estimates were made for dredging a channel and ships turning basin in Panama Harbor to permit the entrance at mean low tide of vessels

drawing 13 feet of water. A topographical survey was made of Changarmi Island by request of the Fortifications Board.

A number of minor surveys were made for municipal improvements and extensions in the Canal Zone and the city of Panama, together with the usual routine progress surveys of dredging and excavation.

#### MAPS.

During the year the various existing division maps and those of the sanitary districts were revised to indicate such changes as were made necessary by the progress of construction work. Two large maps were made, one showing the water system of the city of Panama and the other showing the sewer system. A large map showing the water system in Ancon was also completed.

#### OFFICE WORK.

In addition to the routine office work on progress records, estimates, specifications, etc., for the various districts of the division, there have been prepared, when necessary, designs for numerous minor structures; detail working drawings for lock construction; mechanical designs for new apparatus, and repair parts for the same; work request drawings for shop orders, etc.

Studies were made of the proposed terminal basin and facilities at Balboa. There were prepared designs and detail sheets for the construction of the reenforced concrete lumber dock at Balboa; plan and details of caisson foundations for upper middle approach wall of the Miraflores locks; traveling gravity concrete-depositing and mixing plant for Pedro Miguel upper approach wall; and four auxiliary mixing plants for Miraflores locks.

A number of topographical plats, etc., were prepared for other departments and divisions, and building permit plans were prepared when required.

In addition, the following structures were designed for the Panaman Government: Reenforced concrete pier; reenforced concrete market; two reenforced arch bridges, and several smaller culverts.

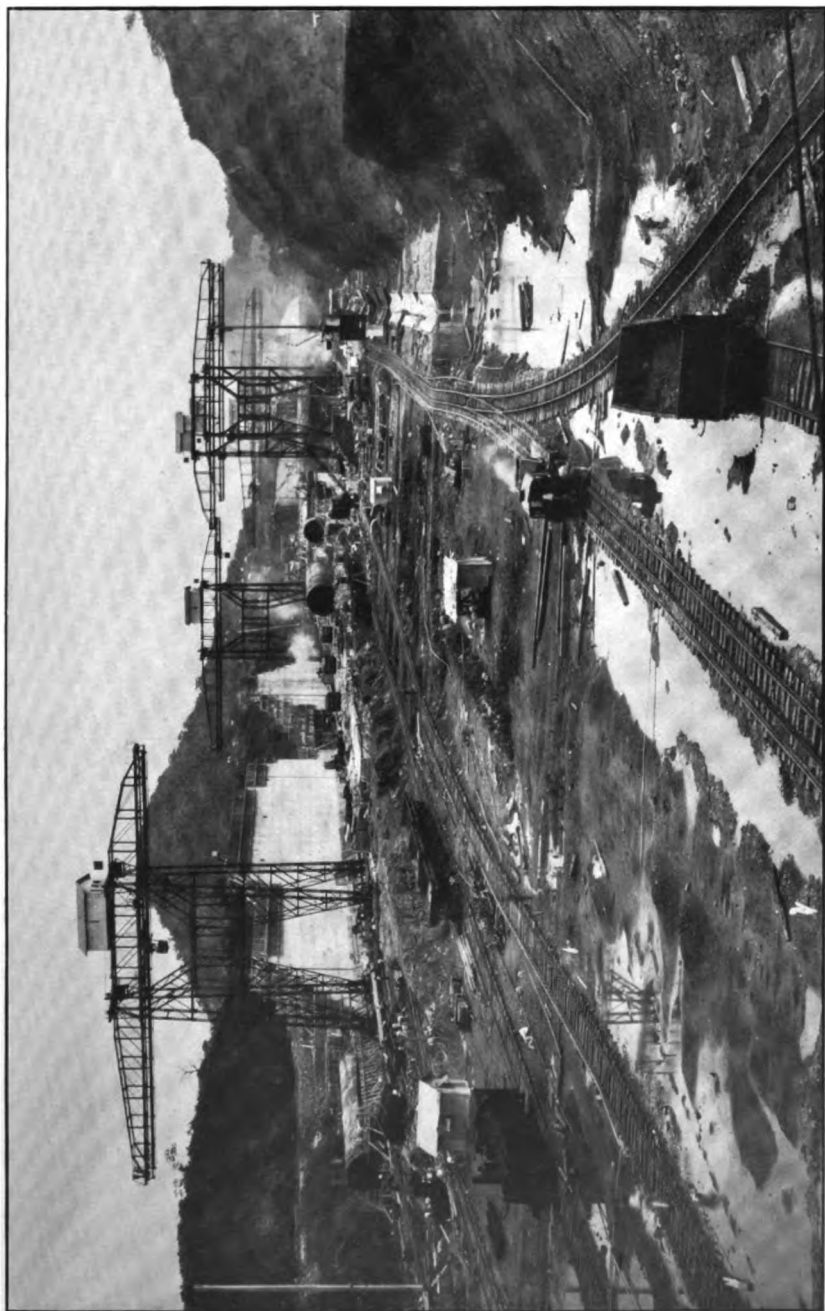
A total of 287 complete drawings were made during the year.

Respectfully,

S. B. WILLIAMSON,  
*Division Engineer.*

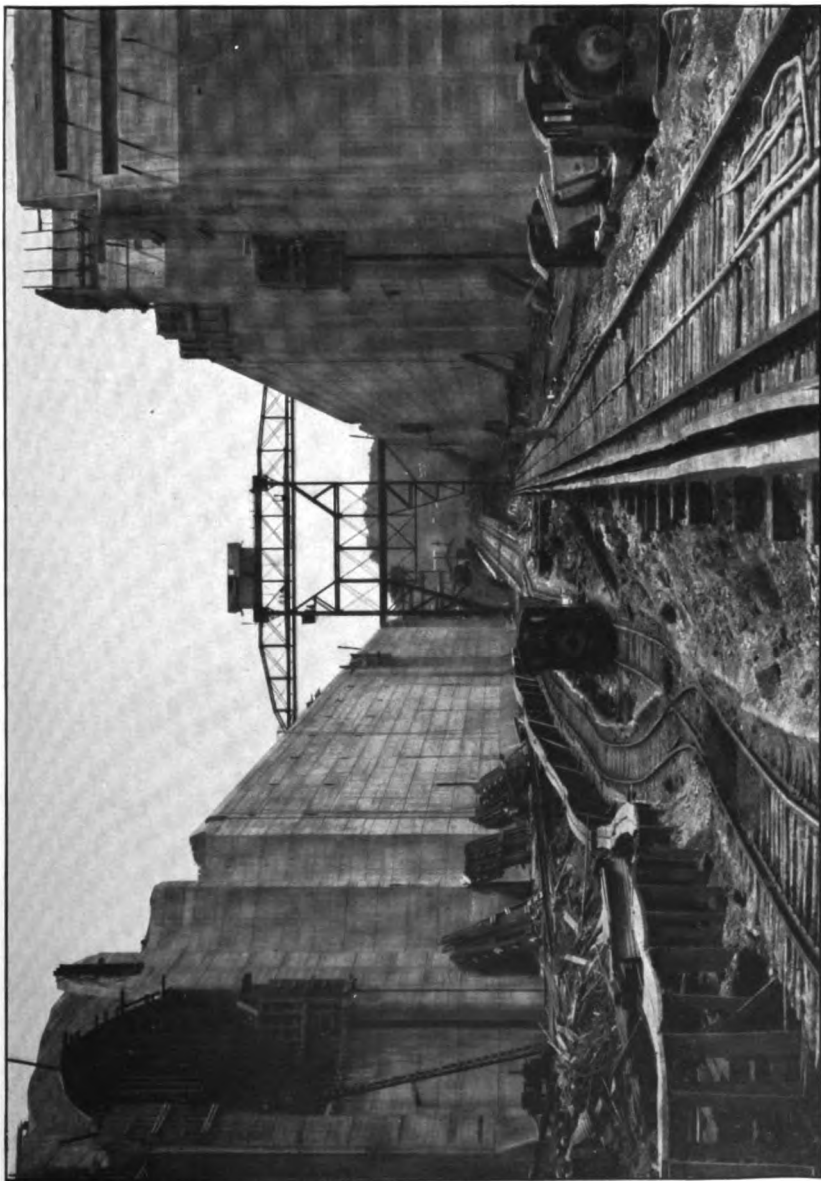
Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer,  
Culebra, Canal Zone.*





PEDRO MIGUEL LOCKS LOOKING NORTH FROM EAST BANK, JUNE 13, 1910.





PEDRO MIGUEL LOCKS, EAST CHAMBER, LOOKING NORTH, JULY 15, 1911.

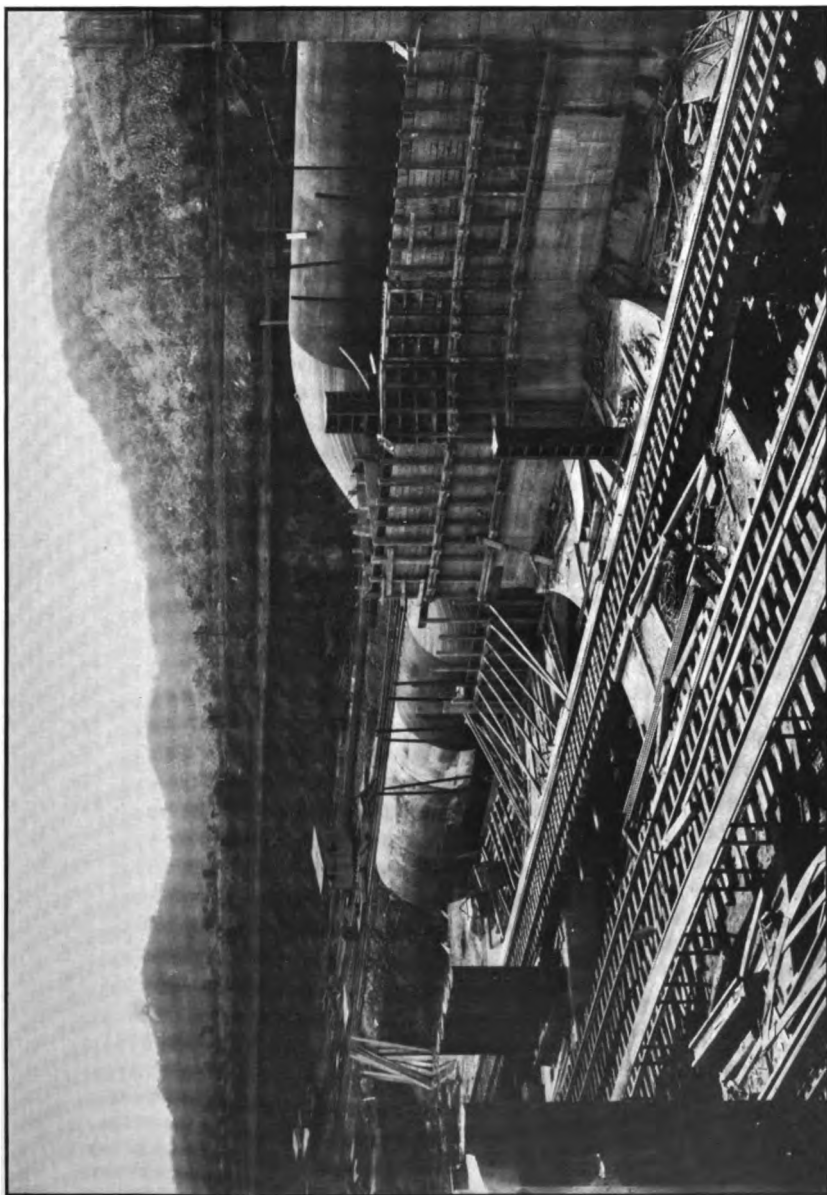






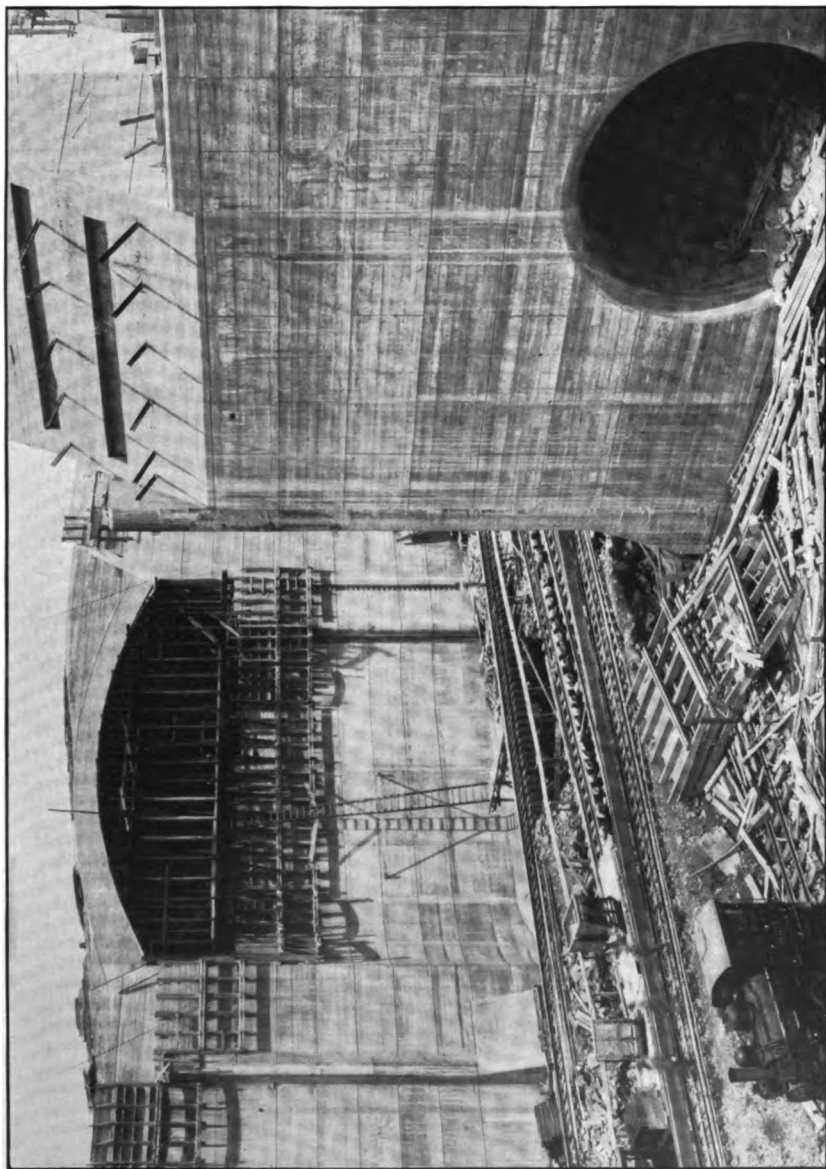
PEDRO MIGUEL LOCKS, WEST CHAMBER, LOOKING SOUTH, SHOWING BRIDGE FOR ERECTION OF LOCK GATES,  
JUNE, 1911.





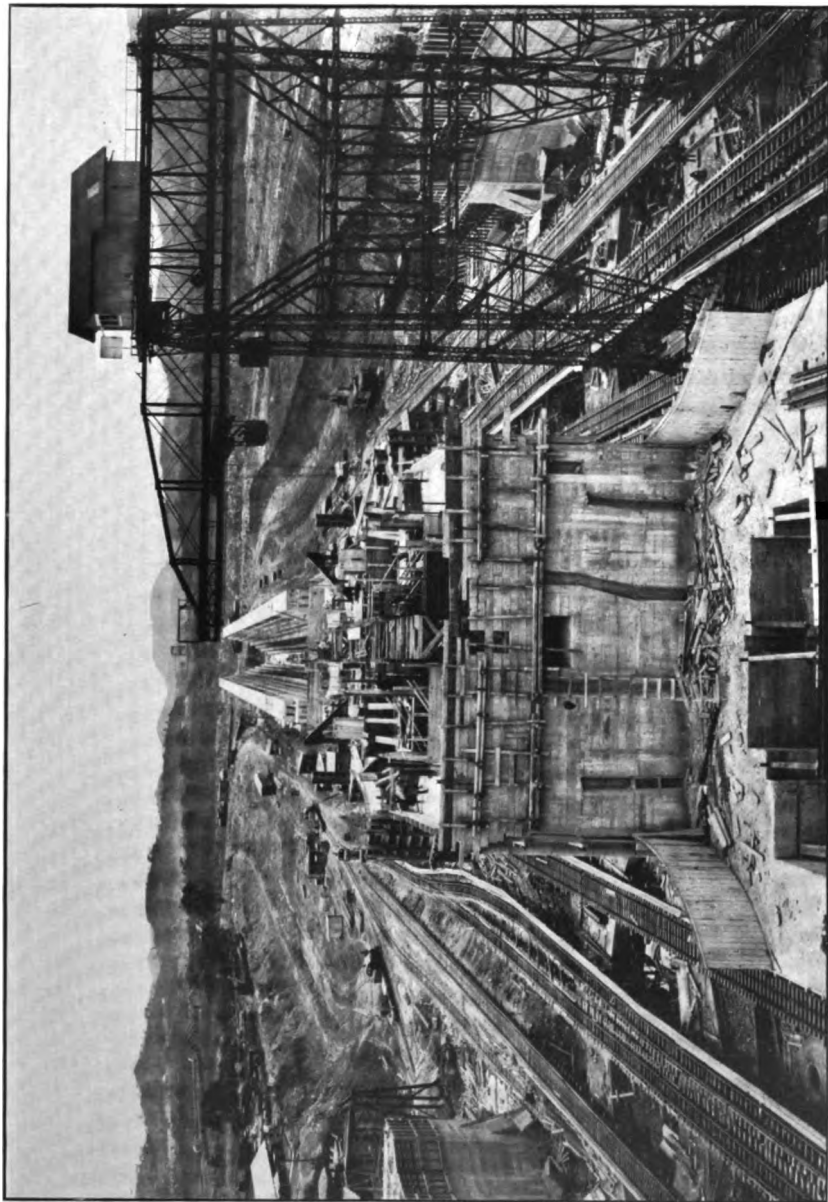
PEDRO MIGUEL LOCKS. LOWER END OF CENTER WALL, SHOWING DROP CURVE IN CULVERT, LOOKING WEST, JANUARY, 1911.





PEDRO MIGUEL LOCKS. LOWER END OF EAST SIDE WALL AND ARCH IN CENTER WALL, JULY, 1911.





PEDRO MIGUEL LOCKS. CHAIN ANCHORAGE, MACHINERY PITS, AND ELECTRIC TUNNEL. LOWER END OF CENTER WALL, LOOKING SOUTH, MARCH 29, 1911.



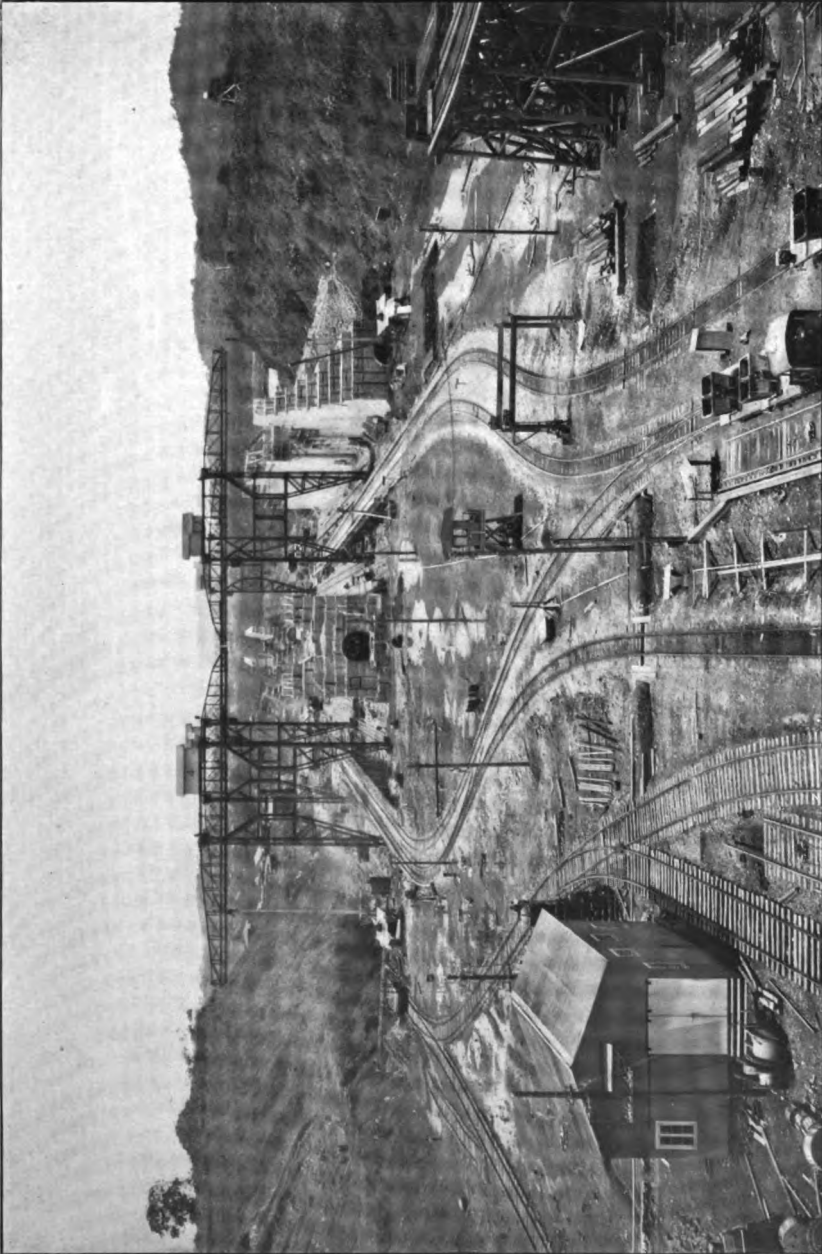




PEDRO MIGUEL LOCKS. CHAIN ANCHORAGE, MACHINERY PITS, AND ELECTRIC TUNNEL. LOWER END OF CENTER WALL, LOOKING NORTH, MARCH 29, 1911.

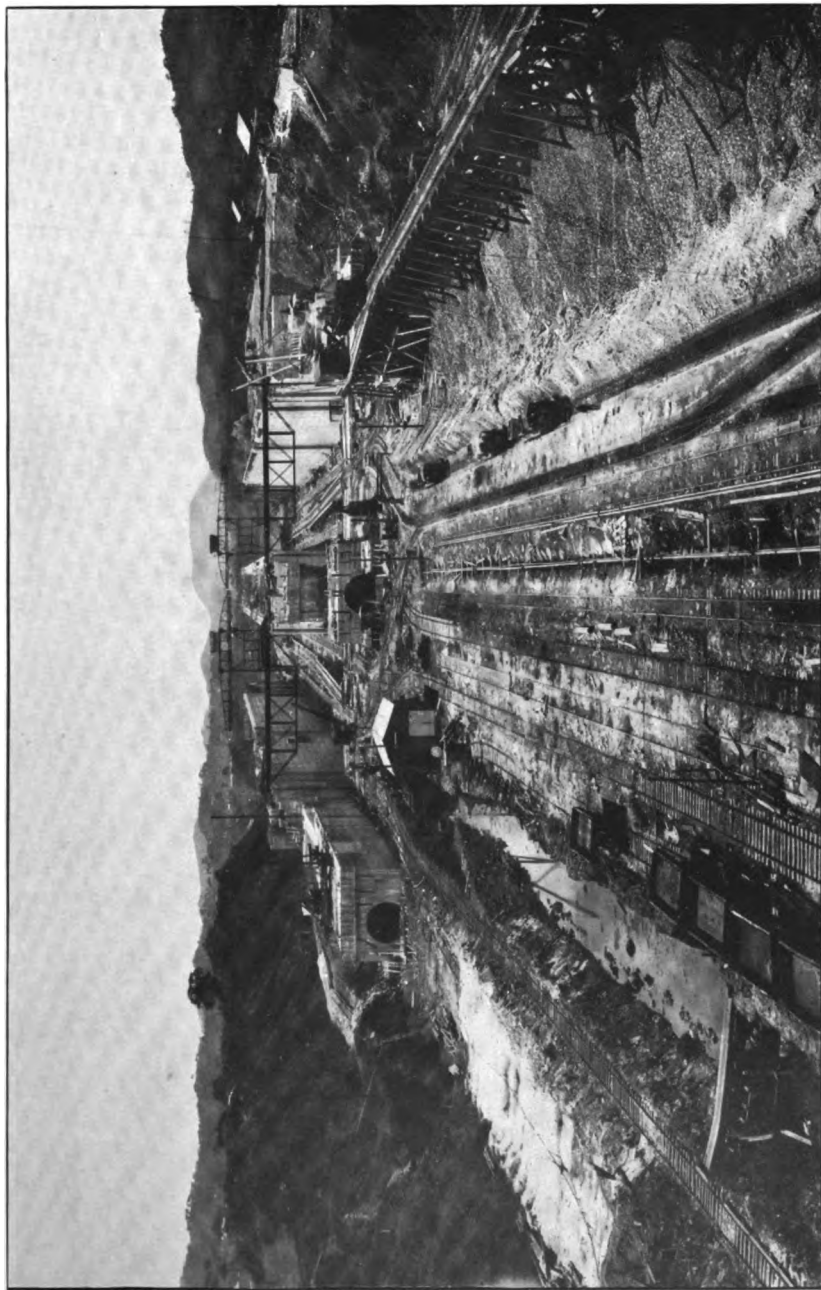


PLATE 51.



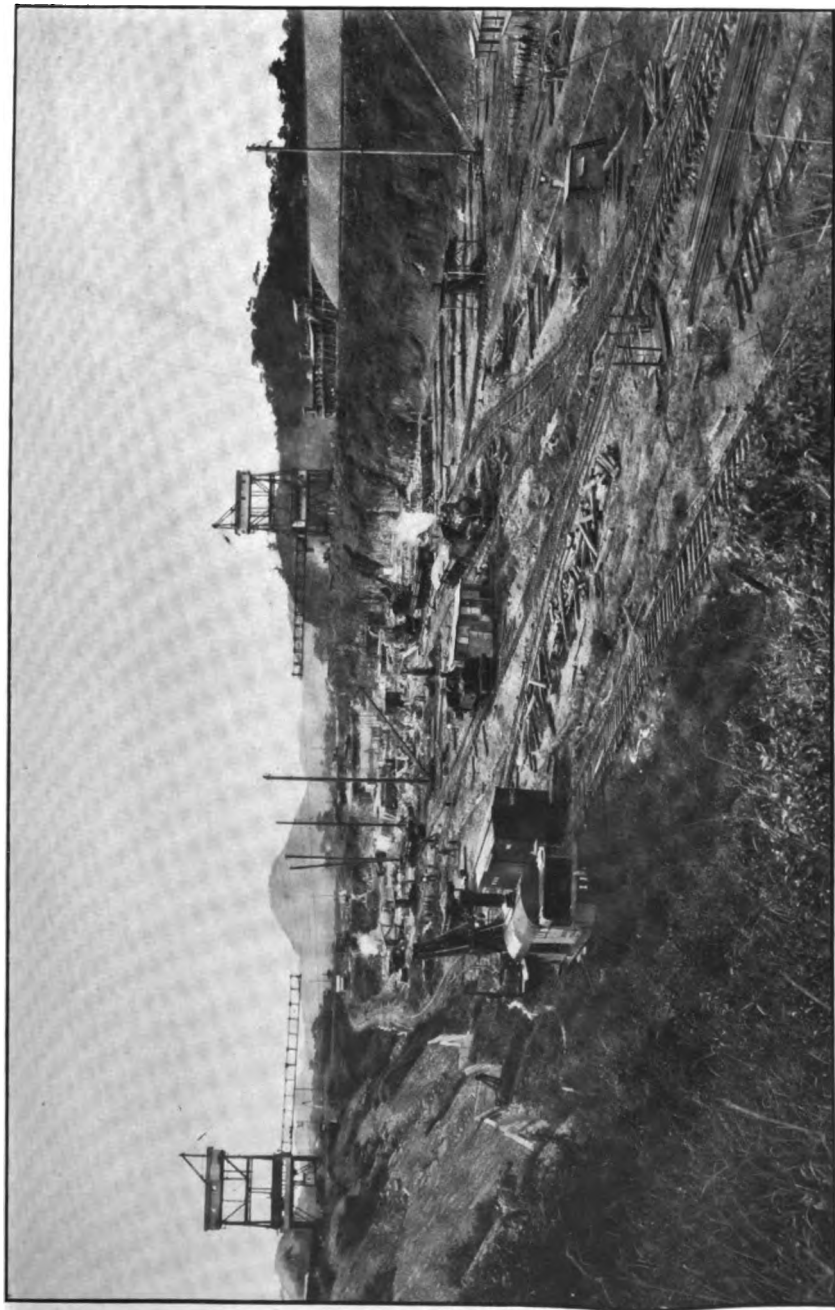
PEDRO MIGUEL LOCKS LOOKING SOUTH FROM MIXING CRANES, JULY 13, 1910.





PEDRO MIGUEL LOCKS. FOREBAY, LOOKING SOUTH, JULY, 1911.

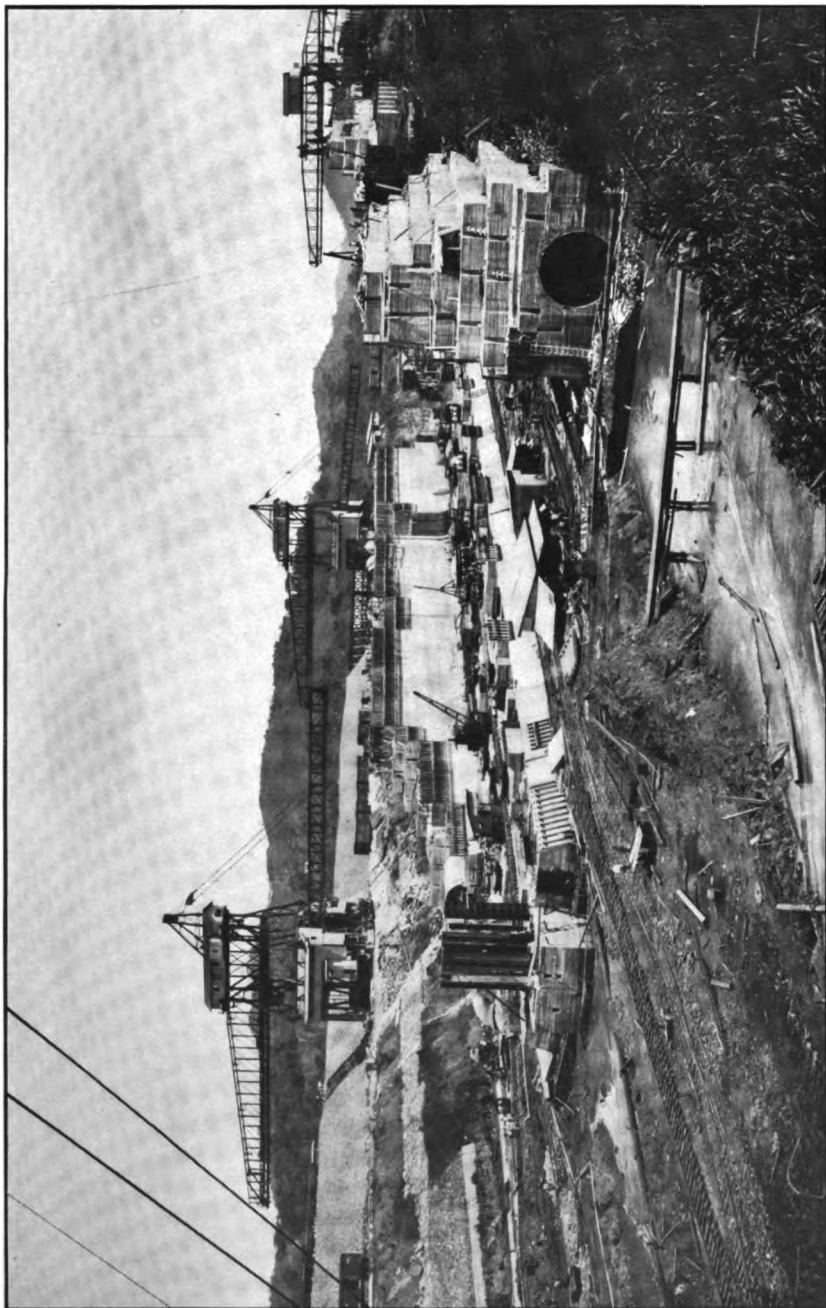




MIRAFLORES LOCKS. GENERAL VIEW OF UPPER LOCKS. LOOKING NORTH, OCTOBER 13, 1910.



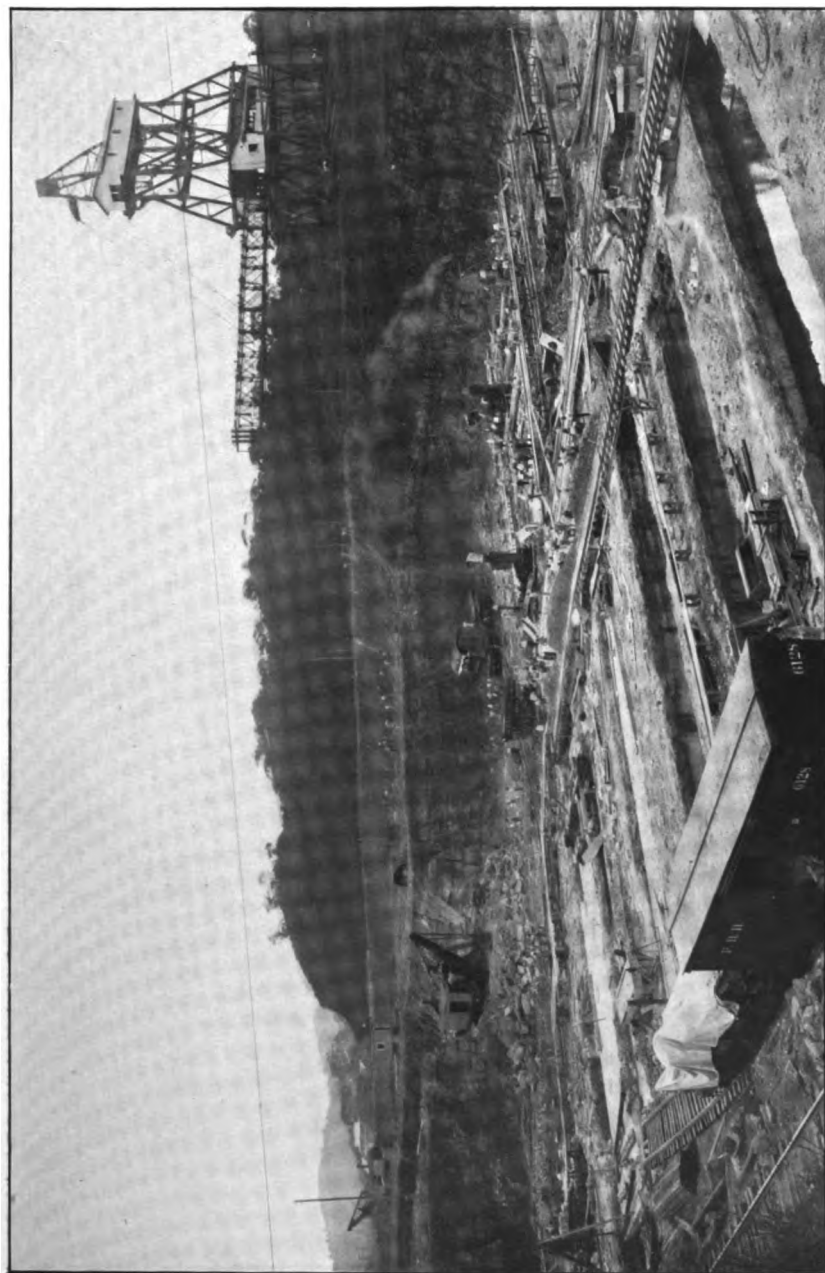




MIRAFLORES LOCKS. UPPER LOCKS, LOOKING NORTHWEST FROM LOWER END, JULY, 1911.

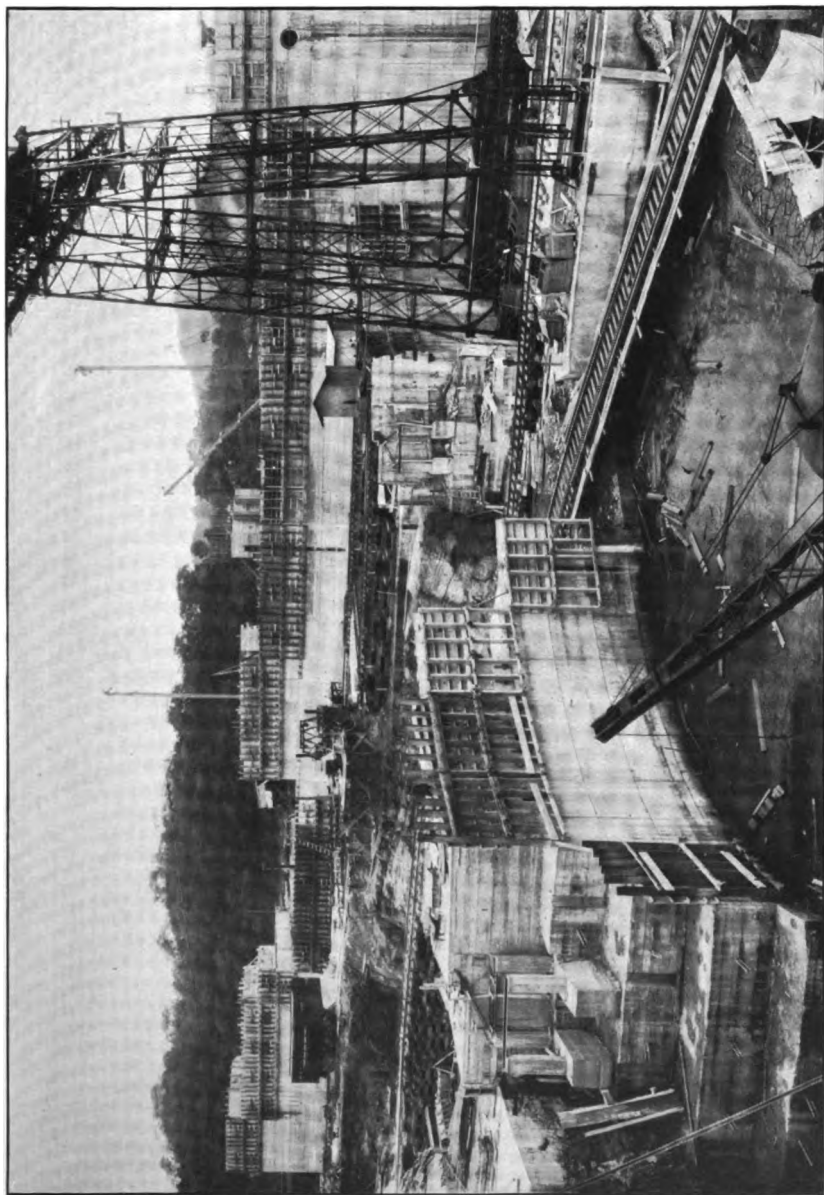


PLATE 55.



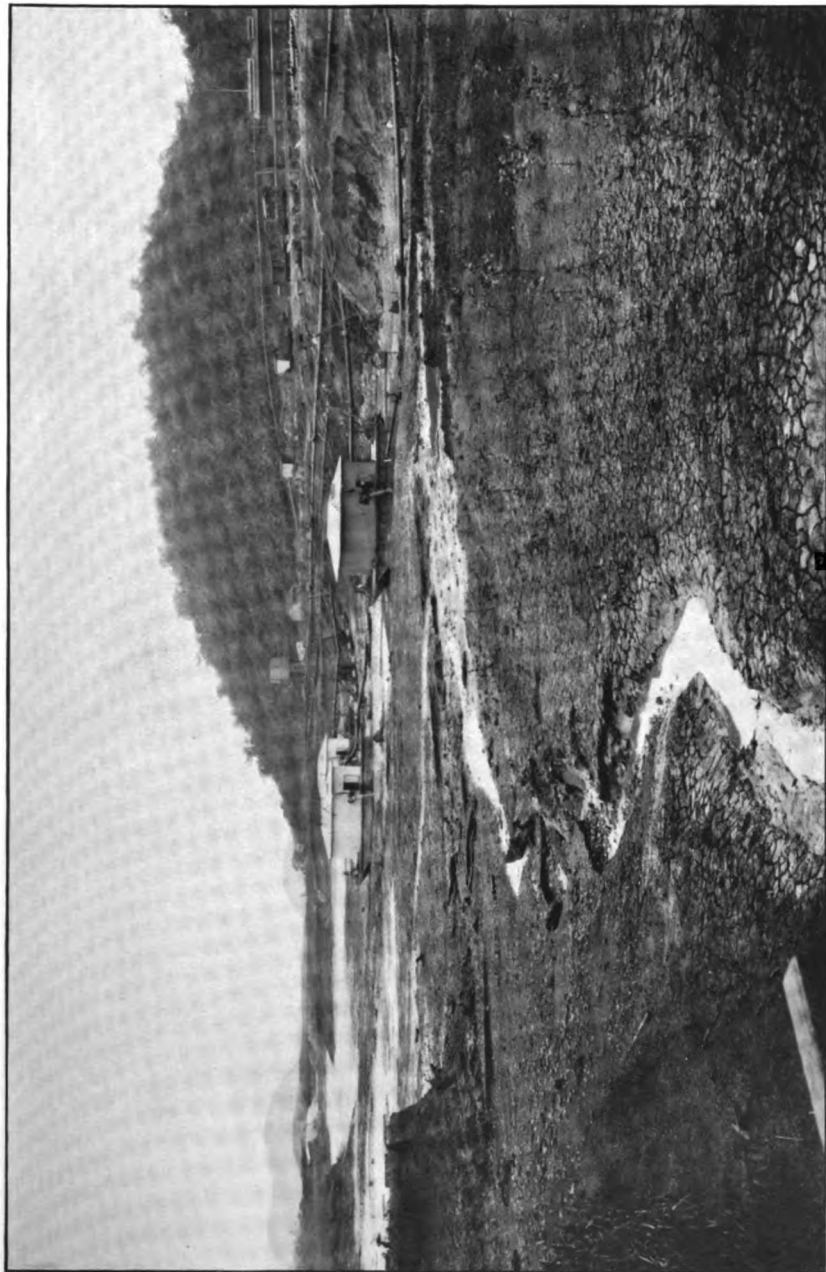
MIRAFLORES LOCKS. EXCAVATING IN UPPER LOCKS FOR LATERAL CULVERTS AND LAYING CONCRETE, JULY 13, 1910.





MIRAFLORES LOCKS. UPPER LOCKS, LOOKING EAST, SHOWING LOWER PART OF FOREBAY AND CONSTRUCTION OF LIFT SILLS, JULY 25, 1911.





MIRAFLORES LOCKS. LOWER LOCK SITE, LOOKING SOUTH, NOVEMBER 11, 1910.



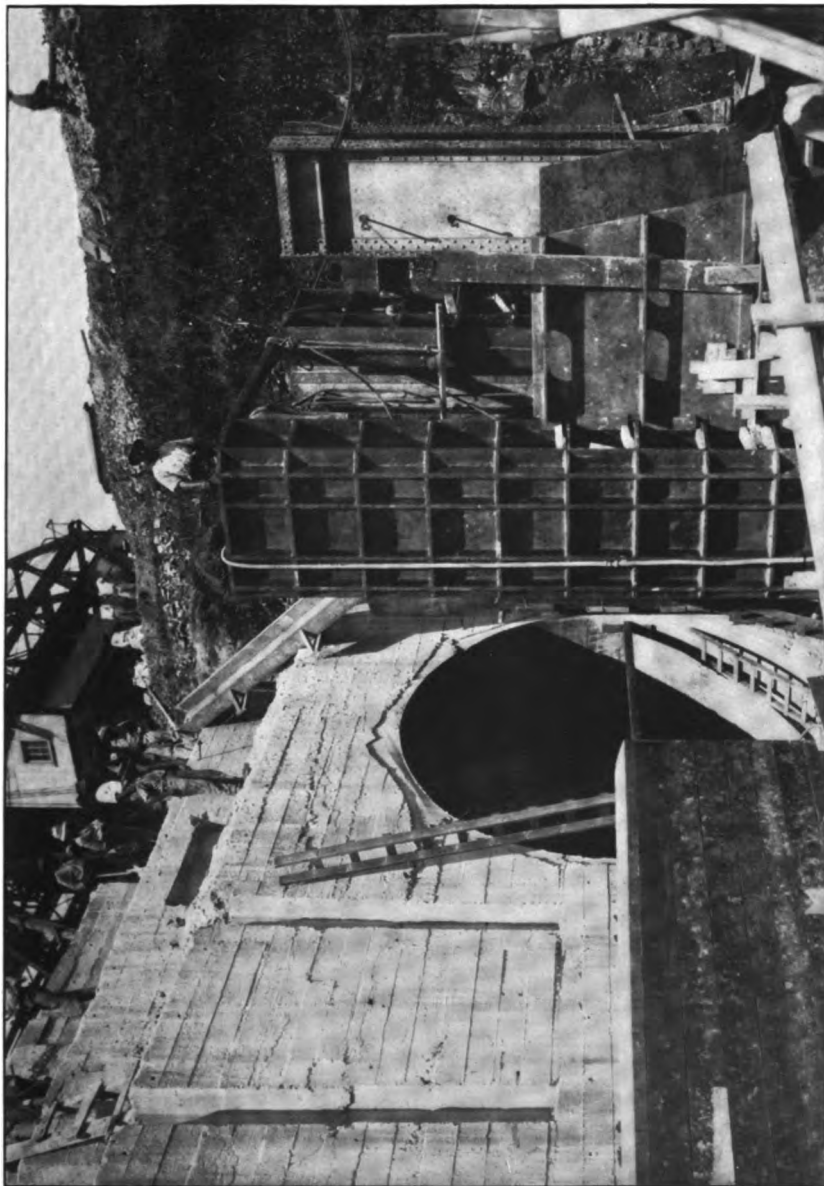


PLATE 68.



MIRAFLORES LOCKS. STEAM SHOVEL EXCAVATION IN LOWER LOCKS, LOOKING SOUTH FROM BERM CRANE, JULY, 1911.

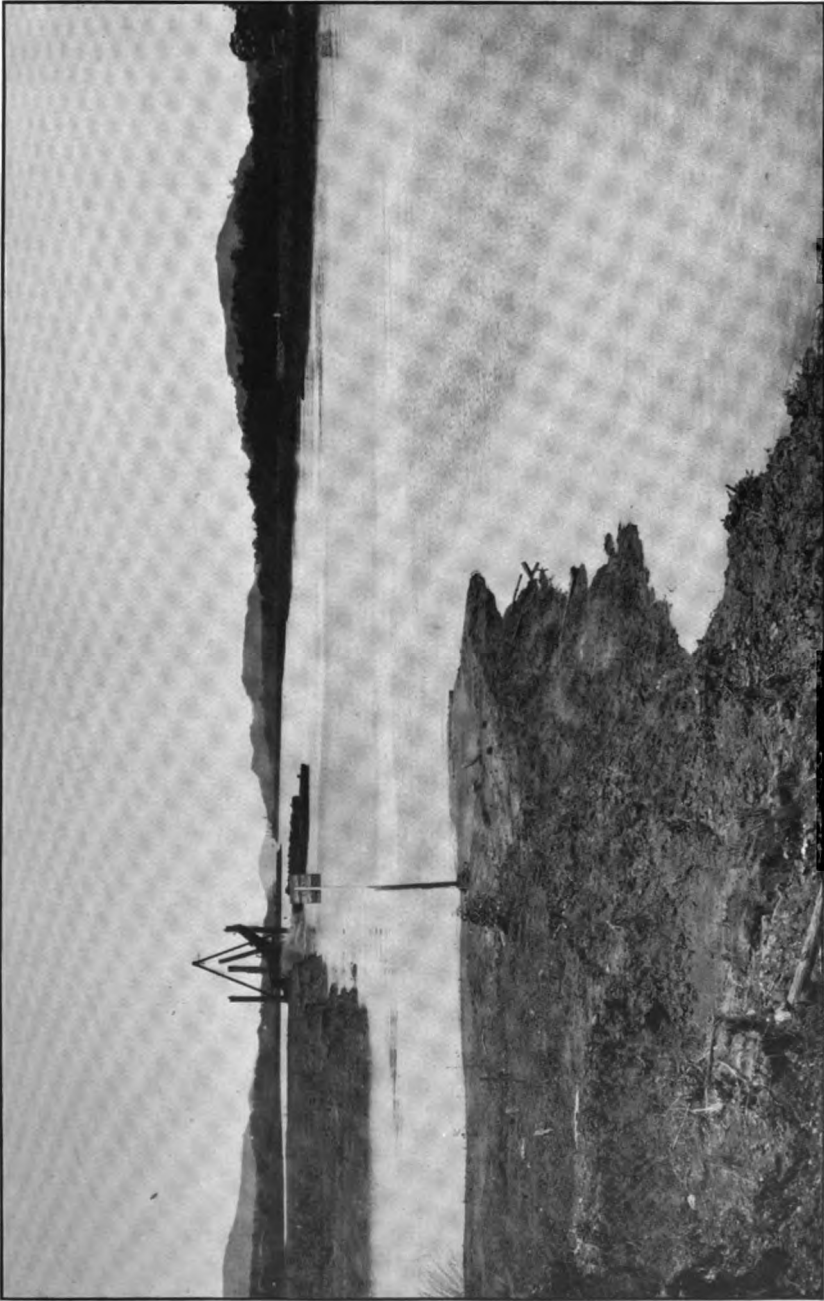




MIRAFLORES LOCKS. STONEY GATE VALVE FRAMES IN POSITION. EAST SIDE WALL, UPPER LOCKS, JANUARY 7, 1911.

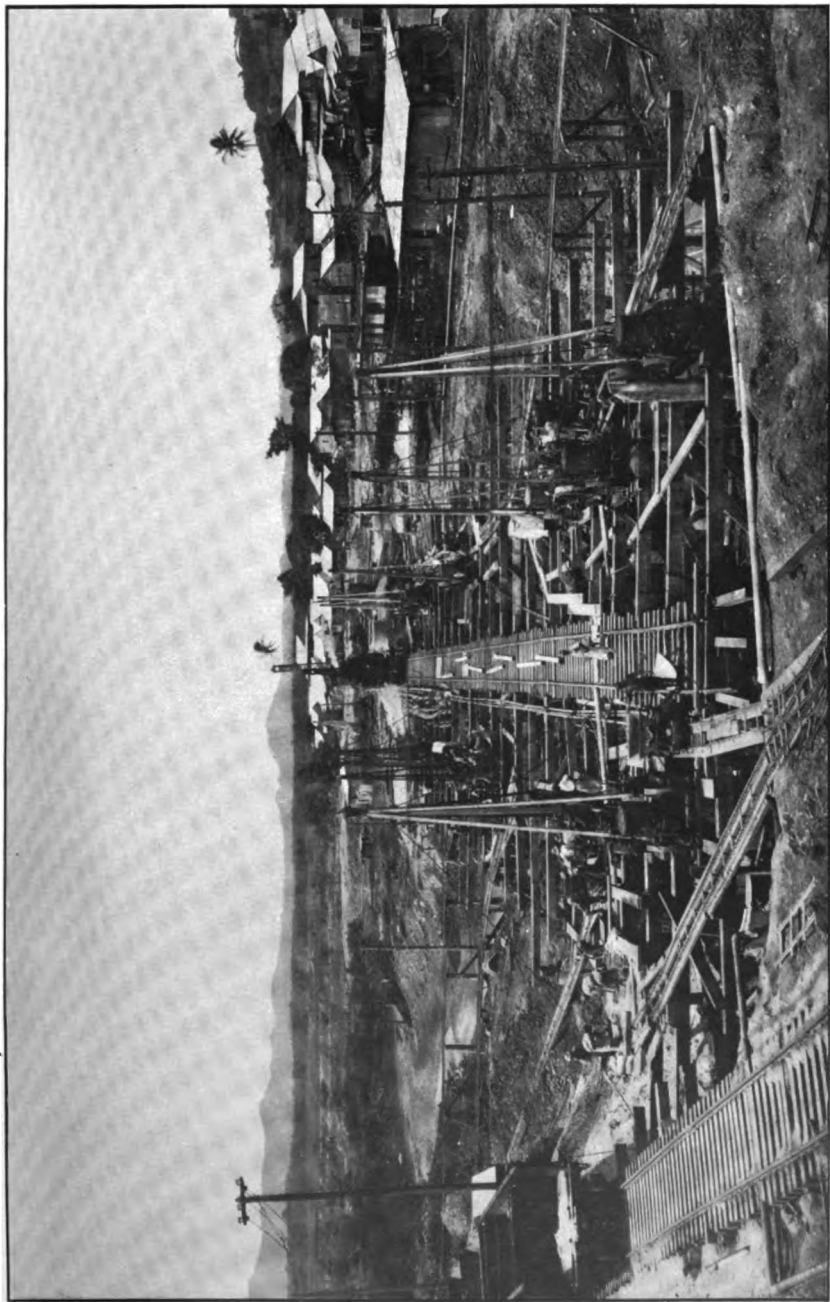


PLATE 60.



CANAL PRISM SOUTH OF MIRAFLORES LOCKS, SHOWING DIPPER DREDGE, JULY, 1911.

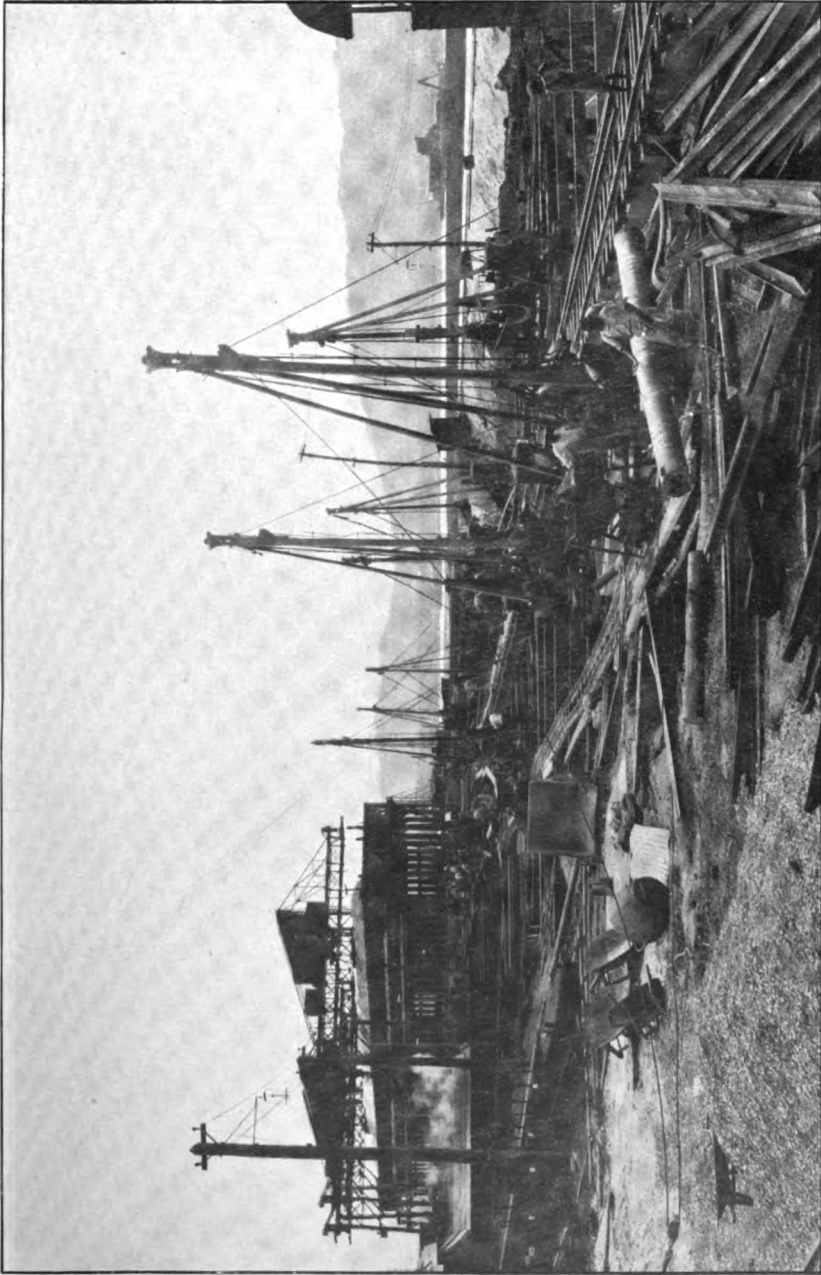




INITIAL WORK ON THE PANAMA RAILROAD DOCKS AT BALBOA, LOOKING NORTH.







INITIAL WORK ON THE PANAMA RAILROAD DOCKS AT BALBOA, LOOKING SOUTH.



## APPENDIX E.

### REPORT OF LIEUT. F. MEARS, U. S. ARMY, CHIEF ENGINEER PANAMA RAILROAD RELOCATION.

PANAMA RAILROAD CO.,  
OFFICE OF CHIEF ENGINEER,  
*Colon, Panama, July 1, 1911.*

SIR: I have the honor to submit the following report of operations of the relocation, Panama Railroad, during the fiscal year ending June 30, 1911:

Construction of the new or relocated line of the Panama Railroad was continued by the Panama Railroad Co. during the year. This work has been under the local charge of Mr. H. P. Warren, engineer of construction, with Mr. M. B. Connolly, superintendent of construction, as assistant.

At the beginning of the fiscal year to which this report pertains all grading on the relocated line from Gatun to Gamboa was practically complete, excepting that portion of the line in the main valley of the Gatun River and its tributaries. This section extends from the Gatun Ridge across the valleys of the Quebrancha, Brazo, Baja, and Gatun Rivers, a distance of 3 miles. These valleys are all low, ranging from elevation +20 to elevation +35 above mean sea level, and in the aggregate contain about 4,000,000 cubic yards. Five hundred and seventy thousand five hundred and twenty-one cubic yards were placed last fiscal year, and in the 12 months of the present fiscal year 2,623,183 cubic yards have been placed. There remained on June 30, 1911, about 850,000 cubic yards to complete this section of the line.

#### LARGE EMBANKMENTS OF THE GATUN VALLEY.

The following statement shows the present condition of the four large embankments crossing the Gatun Valley:

Name.	Height.	Total yards.	Total to date.	Balance to be placed.	Per cent completed.
	<i>Feet.</i>				
Quebrancha, 1,704 feet.....	71	840,405	653,505	186,900	78
Brazo, 4,282 feet.....	60	1,598,936	1,112,036	486,900	70
Baja, 1,490 feet.....	67	570,925	495,925	75,000	87
Gatun, 5,458 feet.....	62	957,238	932,238	25,000	97

#### BORROW PITS.

A few main line cuts remained to be excavated at the close of last fiscal year, and this yardage was all used in building the embankments across the valley. The greater part of the material for these

fills was secured, however, from borrow pits. Early in the season several large borrow pits were opened up in close proximity to the dumps, and these have been worked throughout the year. The steam-shovel output from these borrow pits has been particularly gratifying. In July, 1910, one model 91 Marion steam shovel was cut in, and in January, 1911, two other model 91 Marion steam shovels were secured to replace steam shovels of the 70-ton class. The attached table, Exhibit 1, shows the work performed by steam shovels on the Gatun-Monte Lirio section during the 12 months of the year.

#### SLIDES AND SETTLEMENTS.

The soundings over these bottom lands showed varying conditions. The ground level of the Quebrancha bottom, at station 330, is at elevation +20, while the soundings show it to be from 150 to 180 feet to solid rock. The rock is overlaid with a soft deposit of sandy clay, with a harder stratum of clay and pure sand near the ground surface. The first deck of this embankment was put in to elevation +50 and filled well over the entire area out to the 2:1 slope stakes. A trestle was then driven at elevation +70, and filling from this level was started when a small settlement occurred on the line of the trestle, with corresponding upheaval of the natural ground beyond the slope stakes. This ground was further counterweighted by filling in well beyond the slope on both sides, and the work of raising the center line to permanent grade was later continued. In this manner, by keeping careful watch on the settlement and upheaval, the permanent embankment has been brought very close to permanent grade at elevation +92. Plate 63 shows photograph of this embankment in the month of June.

There has been no settlement on the Brazo bottom so far, and in some places the embankment is within 8 feet of permanent grade. Plate 64 shows photograph of this fill, taken in the month of March.

The Baja bottom at station 420, however, has continued to give a great deal of trouble. The elevation of the natural ground at this point is +25, and it is about 60 feet from top of ground to solid rock. The material intervening is the softest kind of clay, decomposed wood, and vegetation. The weight of the filled-in earth and rock has pushed away the softer material and practically settled to bed-rock. This embankment is now within 10 feet of grade, with a heavy counterweight on either toe, and it is anticipated that it can be completed within a short time. Plate 65 shows condition of this embankment in March, 1911, after a small settlement on the east toe had occurred. Plate 66 shows the same view, taken three months later, after over 125,000 yards of material had been placed.

A small settlement occurred at the south end of Gatun River Valley in the month of June. This embankment was raised to grade of +97 to conform to the permanent bridge at this point, and the excessive weight caused a small slide to develop along the west toe, which rolled and pushed up the natural ground for a distance of 200 or 300 feet. This upheaval has now been filled over and counterweighted and no further trouble is anticipated.

#### PERMANENT BRIDGE, GATUN RIVER.

The reenforced-concrete piers for the permanent bridge at the Gatun River were built during the months of January, February, and March.

These piers are designed to carry the three new plate girders which now form the three north spans of the Barbacoas Bridge in the operated line. A creosoted pile bridge was driven along the west side of these piers, to be available for operation during the dismantling of the Barbacoas Bridge and the erection of the girders at this point. The accompanying photograph, Plate 67, shows the reenforced-concrete piers in March, 1911.

Pier No. 3 will be used for trunnion pier for a bascule bridge. It is proposed to convert one of the old plate-girder spans into a lift span during the next fiscal year by the installation of lifting mechanism. This bridge will thus provide for free access to the east arm of Gatun Lake, with a channel 85 feet wide and minimum depth of water of 45 feet.

#### GOLD HILL LINE.

Under the original plans for the construction of the new Panama Railroad through the Culebra cut it was the intention to locate the new line on a 40-foot berm at +95 level. Due to numerous slides which developed along the east side of Culebra cut and which would threaten a track in this location, a board, consisting of Mr. H. H. Rousseau, chairman, Maj. Chester Harding, member, and Lieut. Frederick Mears, member, was appointed by the chairman and chief engineer to consider the matter and make recommendations. This committee in a report dated July 23 recommended that the berm line through the Culebra cut for the permanent railroad be abandoned, and that the so-called high line around Gold Hill be adopted. Some of the reasons which led the committee to make this recommendation, as set forth in the report, are quoted below:

1. The disadvantages and inconveniences arising from the difficulty of access with such a "berm-line" track so far below the level of the natural ground between Gamboa and Pedro Miguel have become more pronounced and have assumed much larger relative weight.

2. During the present rainy season, as the excavation in the cut has gone deeper, the difficulty of keeping the berm-line road free from interruption before the banks have taken their final slope, which can not be expected to occur until some time after the completion of the canal, has become more evident, and is now a potent factor in considering this question.

3. With a high line for railroad traffic and a berm line for construction and maintenance work only, the committee believes that the omission of the greater part, if not all, of the concrete retaining walls through the cut, the construction of which was originally contemplated, can be seriously considered. These retaining walls could only be built at a large expense, and there is some doubt as to their necessity and permanent value. The estimate of December, 1908, included an item of \$4,000,000 for these retaining walls.

All of these reasons, therefore, indicated the economy and desirability of running the relocated line, Panama Railroad, on the so-called high line around Gold Hill.

#### FIELD LOCATION.

This report having been approved by your letter of July 26, 1910, steps were taken to make the necessary field surveys. Inasmuch as there were five locating parties soon to be available from the Panama Government Survey, no new engineers were secured to make these surveys. It was decided to utilize the first available party released from the Empire-David Survey for work on the Gold Hill line. A careful field reconnaissance was made over the entire area by Mr. H. P. Warren, engineer of construction, and the undersigned. The problem was to locate a line connecting the south end of Gamboa

Bridge, at the Chagres River, with the completed portion of the relocated line near Pedro Miguel. It was necessary to locate the new line well away from the east edge of the Culebra Cut, in order to be beyond the menace of any of the numerous slides. Preliminary reconnaissance and careful study of available maps showed three critical points, namely:

First. The section from Gamboa Bridge south, which involves getting out of the canal section at the north end of the Culebra Cut, and reaching the high level of the natural ground along the east bank.

Second. Crossing the La Pita Divide. The La Pita ridge lies perpendicular to the general axis of the canal, forming quite an obstacle for any road crossing that section.

Third. Crossing a high divide near the town of Paraiso.

The 1:40,000 map [reduced to 1:80,000, Pl. 117] attached to this report, will show the general topography of this country, as well as approved final location.

A field locating party started work about October 1 at Pedro Miguel, and running north, carried the preliminary line to the Gamboa Bridge. At first it was the aim and intention to keep this line close to the diversion track built by the Central Division in order to facilitate construction and the delivery of construction material, but it was early decided to adopt a  $1\frac{1}{2}$  per cent grade, and locate the line independently of this track, in order to secure a roadbed benched in on the solid ground, beyond the sphere of any influence of slides in the Culebra Cut. The surveys were commenced at the south end because it was extremely desirable to secure a location in close proximity to the present towns of Paraiso and Pedro Miguel. Field work soon developed the fact that by using  $1\frac{1}{2}$  per cent grade northbound, and taking an exceedingly heavy cut in the ridge back of Paraiso, a suitable line could be secured which would lie close to the towns above mentioned, as well as take advantage of a mile of track which had already been constructed in connection with the original relocated line. From the heavy saddle cut near the town of Paraiso, the line runs up the valley of the Pedro Miguel River, which is quite narrow, with steep rugged sides. About 4 miles from Pedro Miguel station, the line turns up a small tributary of the Pedro Miguel River through an angle of nearly  $90^\circ$ , using  $7^\circ$  curve, and approaches the Continental Divide. The Continental Divide is a low, easy saddle, after crossing which the line continues over the valleys of the Rio Gamboa, Rio Obispo, and Rio Mesambi. This section is fairly easy railroad ground, and is probably the least expensive to construct. The next difficulty encountered is the crossing of the range of hills dividing the basins of the Rio Mesambi and the Rio Sardinilla, commonly called the La Pita Divide, from the name of one of its prominent hills on the canal slope. Lines were located through several saddles, and the one finally adopted lies about 1 mile east of the canal axis. From the Rio Sardinilla the located line skirts the base of a very high range of hills for about 1 mile, and crosses the diversion of the Rio Obispo on a triple 10 by 10 concrete box. This diversion was built by the Canal Commission to divert the waters of the numerous streams on the east side of the Cut and carry them into the Chagres River, above the Gamboa Bridge. The crest of the grade was reached at Station 1549, near the La Pita Divide, which is at elevation plus 270. The line from the Gamboa Bridge to the La

Pita Divide was built on a practically continuous plus  $1\frac{1}{4}$  per cent grade, southbound, and the line so located as to interfere as little as possible with the movement of the Central Division spoil trains over the Gamboa Bridge. Final location for this line was completed about February 1, although construction over other settled portions was undertaken before this date.

The usual difficulties incident to railroad location in a tropical country were encountered on these surveys. Progress was limited by the amount of line which the machete men could cut out in one day, varying from three to six thousand feet, depending upon the character of the jungle. All topography was taken by accurately locating contours on 10-foot vertical interval. The sickness among the men made frequent changes in make-up of the parties necessary. This was largely due to the fact that these men had been on the Panama Government Survey for some months in the tropical jungle, and away from good medical attention.

From the increased knowledge of the country, gained during the construction, only minor changes of alignment have been necessary, and these were all put into effect before construction work was started. It is believed without question that we have secured the best line that the country affords.

#### CONSTRUCTION.

Construction was commenced January 1, 1911. The work was greatly aided by the fact that experienced foremen were available from other sections of the relocation, and by the proximity to a large part of the work of the Isthmian Canal Commission's diversion track.

On the whole line, the cut and fill about balance at 1,125,000 cubic yards. There were 9,000 cubics yards of concrete to be placed in culverts, and  $2\frac{1}{4}$  miles of temporary trestle to be driven. The length of the line is  $9\frac{3}{4}$  miles. Of the grading, about 275,000 cubic yards were handwork, the remainder steam shovel work. The grading was placed in the hands of Mr. M. B. Connolly, superintendent of construction, who is in charge of the same work on the rest of the relocation. A bridge and culvert department was organized with Mr. Ed. Slayback, as supervisor, and the engineering was left in charge of Mr. L. K. Needham, who had charge of location.

A small section of line between the Obispo diversion crossing and the Rio Sardinilla was let by contract to Mr. J. B. Hull. This consisted of about 75,000 cubic yards of handwork, and was to be finished by August 1, 1911. A flat price of 57 cents per cubic yard was paid for this grading, the railroad furnishing tools and Decauville equipment.

In order to facilitate construction work with standard gauge equipment, a connection track, known locally as spur No. 23, was built from the central division diversion track to touch a point on the Gold Hill line at station 1660. This spur was built in the month of February. All grading for small main line cuts and for shoo-fly tracks was done with Decauville equipment, and this work was rushed in order to take advantage of the dry season and open up the line for further work of steam shovels and pile drivers.

Trestles were driven across all deep valleys. Untreated piles and second-hand decking from former work were used. Plate 68 shows the largest of these trestles across a valley back of Paraiso under construction, and Plate 69 shows another after completion.



The work was so laid out that all available construction plant should be used continuously, and, as a matter of fact, there were no delays waiting for grading nor fortunately for material. Culverts were built where possible by hauling in gravel and cement over standard track; in a number of cases grading would have been delayed by waiting on this method and material was therefore hauled in by wagons and carts, or else rubble masonry culverts were built, with stone picked up near the site. By the end of the fiscal year, the culvert work was 85 per cent complete and the trestles were 95 per cent complete. The first steam shovel started work on February 24, 1911, in the high ridge south of Gamboa. The second steam shovel began work about March 15, in the saddle cut at Paraiso, and the third steam shovel a fortnight later, at the end of spur 23. Plate 70 shows some heavy cuts taken out by the task system, near the Pedro Miguel end of the line. Following is the summary work done on the Gold Hill line for the fiscal year:

Total excavation.....	cubic yards..	696, 742
Concrete placed.....	do.....	7, 034. 7
Trestle driven.....	linear feet..	11, 446
Temporary track.....	do.....	53, 639
Clearing done.....	acres..	256. 93
Total expenditures to July 1, 1911.....		\$498, 610. 41

#### PERMANENT TELEGRAPH LINES.

The construction of a permanent telegraph and telephone line was undertaken during the year. This line is built, utilizing 56-pound steel rails for poles, the same being equipped with four cross-arms, 10 pins to the arm, making 40-wire line. No. 10 hard-drawn copper wire was used. On June 30 the line from Gatun to Gamboa Bridge was 50 per cent complete.

#### BALLAST—PERMANENT TRACK.

Ballasting operations along the permanent track of the relocated line were continued throughout the year. Chagres River gravel was used for this purpose, secured from the pit operated by the Panama Railroad Co. at Gamboa. About 6 miles of 90-pound steel was put down in the completed section of the line near Gatun and south of Monte Lirio. This 90-pound steel was laid in large part on hardwood ties, with patent tie plate and screw spike equipment.

#### COMPLETED SECTION TURNED OVER FOR OPERATION.

The section of the relocated line from Paraiso Junction to Corozal Junction, a distance of 4.1 miles, was formally turned over to and accepted by the Panama Railroad Co. on September 4, 1910.

It is anticipated that the Gatun-Gamboa section of the relocated line will be ready to turn over to the Panama Railroad Co. for traffic on February 1, 1912, and that the Gold Hill line will similarly be ready for main-line traffic on April 1, 1912.

Respectfully submitted.

F. MEARS, *Chief Engineer.*

Col. GEO. W. GOETHALS, U. S. Army,  
*President Panama Railroad Co., Culebra, Canal Zone.*

**EXHIBIT 1.**—*Statement showing output of steam shovels on the Gatun-Monte Lirio section of the relocated line, for the fiscal year 1910-11.*

Steam shovel No.—	Capacity of dipper.	July.		August.		September.		October.	
		Car report.	Cross section.	Car report.	Cross section.	Car report.	Cross section.	Car report.	Cross section.
105.....	3 yards.....	<i>Cu. yds.</i> 26,970	<i>Cu. yds.</i> 21,330	<i>Cu. yds.</i> 35,920	<i>Cu. yds.</i> 38,030	<i>Cu. yds.</i> 20,160	<i>Cu. yds.</i> 19,065	<i>Cu. yds.</i> 38,580	<i>Cu. yds.</i> 36,570
106.....	.....do.....	27,365	25,900	28,940	30,520	12,200	11,980	.....	.....
110.....	.....do.....	16,770	17,700	50,630	47,405	27,120	27,446	28,790	32,250
113.....	.....do.....	8,890	8,950	11,900	11,130	22,280	21,990	34,410	30,370
117.....	.....do.....	17,560	17,965	.....	.....	.....	.....	.....	.....
121.....	.....do.....	36,290	37,780	40,670	44,230	41,480	40,490	47,820	44,600
123.....	.....do.....	28,860	28,790	30,340	36,030	33,705	33,645	43,950	41,550
257.....	5 yards.....	20,360	17,730	31,650	29,720	37,840	39,755	58,030	53,009
Total.....		183,095	176,125	230,050	237,065	194,865	194,371	251,580	238,349
Steam-shovel days...		159		160		140.5		156	
Average output per steam shovel.....		1,108		1,482		1,383		1,528	

Steam shovel No.—	Capacity of dipper.	November.		December.		January.		February.	
		Car report.	Cross section.	Car report.	Cross section.	Car report.	Cross section.	Car report.	Cross section.
105.....	3 yards.....	<i>Cu. yds.</i> 30,570	<i>Cu. yds.</i> 32,115	<i>Cu. yds.</i> 23,640	<i>Cu. yds.</i> 26,170	.....	.....	.....	.....
107.....	.....do.....	16,800	17,510	39,660	40,730	27,620	28,590	23,960	26,620
110.....	.....do.....	28,270	32,165	31,330	37,730	13,660	16,240	.....	.....
113.....	.....do.....	14,380	14,500	.....	.....	.....	.....	.....	.....
117.....	.....do.....	17,790	16,390	39,380	38,500	38,390	38,030	38,200	39,990
121.....	.....do.....	23,820	24,840	8,360	9,030	38,160	38,175	34,430	34,940
123.....	.....do.....	36,660	36,660	34,120	34,120	16,050	16,030	.....	.....
257.....	5 yards.....	50,020	53,330	50,660	47,440	56,730	57,310	60,210	58,895
262.....	.....do.....	.....	.....	.....	.....	34,750	33,230	53,280	53,920
266.....	.....do.....	.....	.....	.....	.....	23,570	23,570	40,530	38,450
Total.....		218,310	227,510	227,050	233,720	248,910	251,175	250,600	252,815
Steam-shovel days...		144		156		150		138	
Average output per steam shovel.....		1,580		1,498		1,675		1,832	

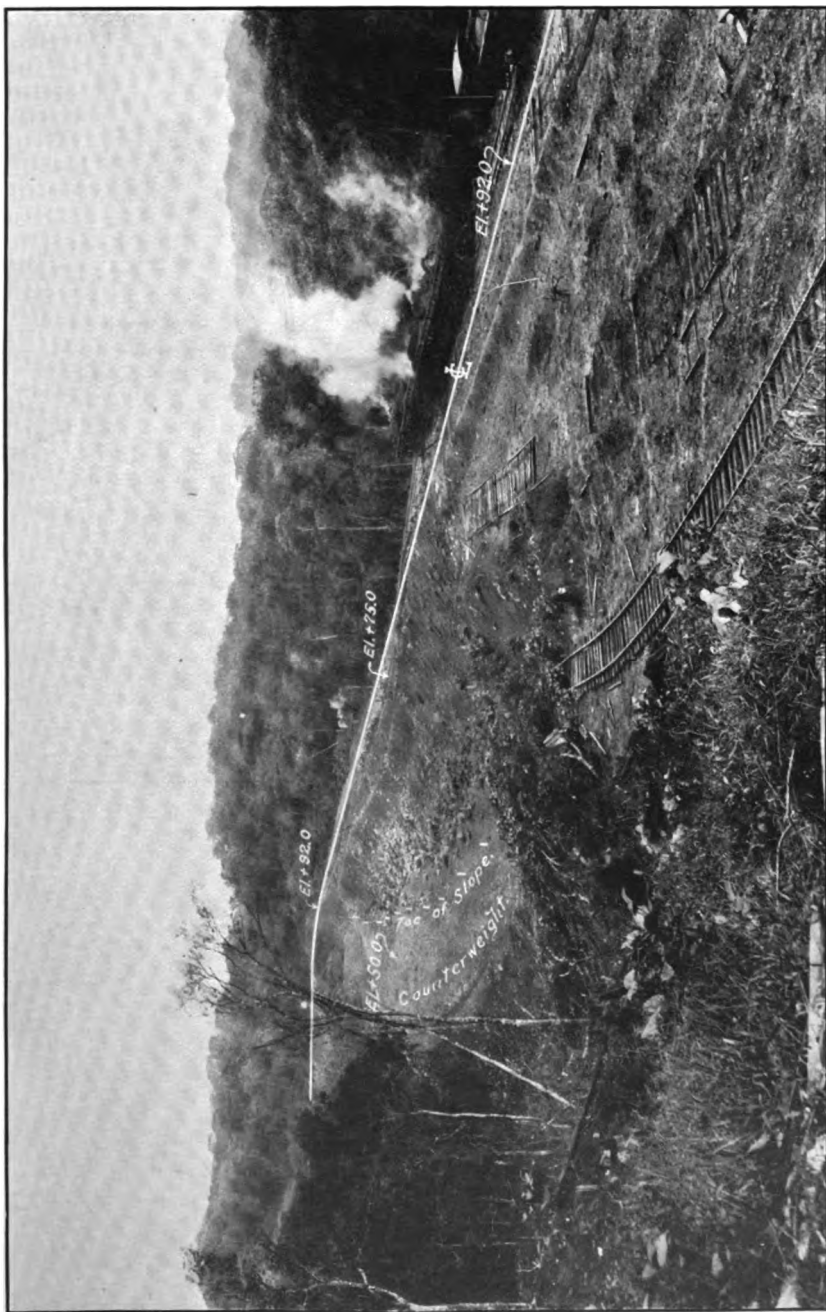
  

Steam shovel No.—	Capacity of dipper.	March.		April.		May.		June.	
		Car report.	Cross section.	Car report.	Cross section.	Car report.	Cross section.	Car report.	Cross section.
105.....	3 yards.....	<i>Cu. yds.</i> 22,080	<i>Cu. yds.</i> 22,785	<i>Cu. yds.</i> 39,230	<i>Cu. yds.</i> 40,730	<i>Cu. yds.</i> 35,200	<i>Cu. yds.</i> 34,860	<i>Cu. yds.</i> 36,730	<i>Cu. yds.</i> 41,000
107.....	.....do.....	8,820	9,070	31,890	30,270	29,960	27,210	22,860	22,360
117.....	.....do.....	46,370	48,160	30,520	29,940	33,980	31,550	28,360	23,700
121.....	.....do.....	20,630	21,600	.....	.....	.....	.....	.....	.....
257.....	5 yards.....	57,900	69,600	61,100	62,540	72,030	70,030	65,260	58,850
262.....	.....do.....	53,150	52,300	54,260	54,000	55,190	57,640	59,210	51,700
266.....	.....do.....	49,960	49,960	49,720	47,235	52,650	47,380	43,790	37,300
Total.....		268,910	273,475	266,720	264,715	278,110	268,670	256,210	234,910
Steam-shovel days...		143		142		155		148.5	
Average output per steam shovel.....		1,912		1,864		1,733		1,582	

EXHIBIT 1.—Statement showing output of steam shovels on the Gatun-Monte Lirio section of the relocated line, for the fiscal year 1910-11—Continued.

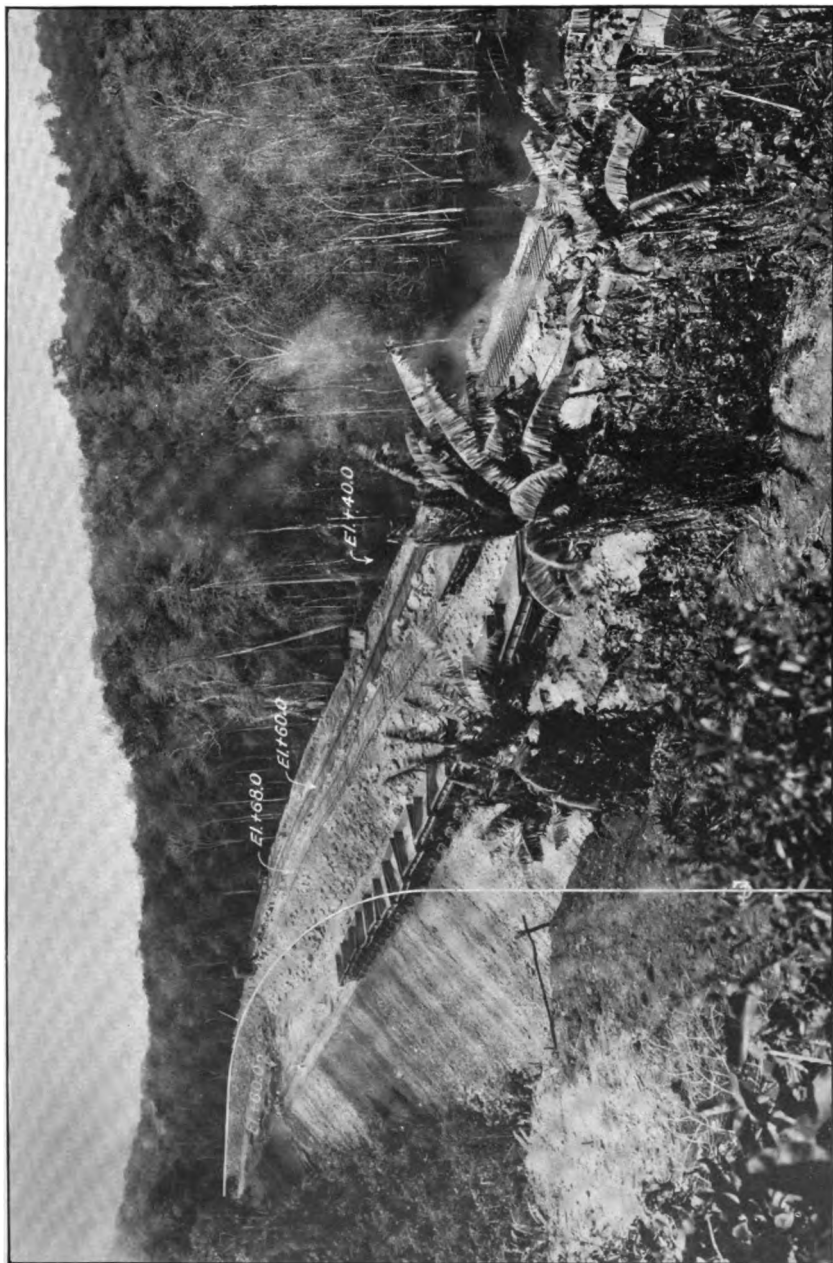
Steam shovel No.—	Capacity of dipper.	Steam-shovel days.	Total output, cross section.	Output per steam-shovel day by cross section.	Remarks.
			<i>Cubic yards.</i>	<i>Cubic yards.</i>	
105.....	3 yards.....	220.5	312,065	1,418	
106.....	do.....	62.0	68,400	1,103	Main line cuts only.
107.....	do.....	156.5	202,360	1,293	Borrow pit.
110.....	do.....	155.0	210,936	1,361	
113.....	do.....	78.0	86,940	1,115	Main line cuts.
117.....	do.....	209.0	284,221	1,360	75 per cent borrow.
121.....	do.....	184.0	285,665	1,607	Borrow pit.
123.....	do.....	165.0	226,825	1,375	Do.
257.....	5 yards.....	280.0	618,209	2,208	6 months main line cut.
262.....	do.....	143.0	302,790	2,117	Borrow pit.
266.....	do.....	139.0	243,595	1,757	Do.
Total.....		1,792.0	2,852,900	1,592	
Average output per steam shovel.....			1,592		

Grand average steam-shovel output, per steam-shovel day, 1,592 cubic yards. Material figures: 40 per cent earth; 60 per cent solid rock.



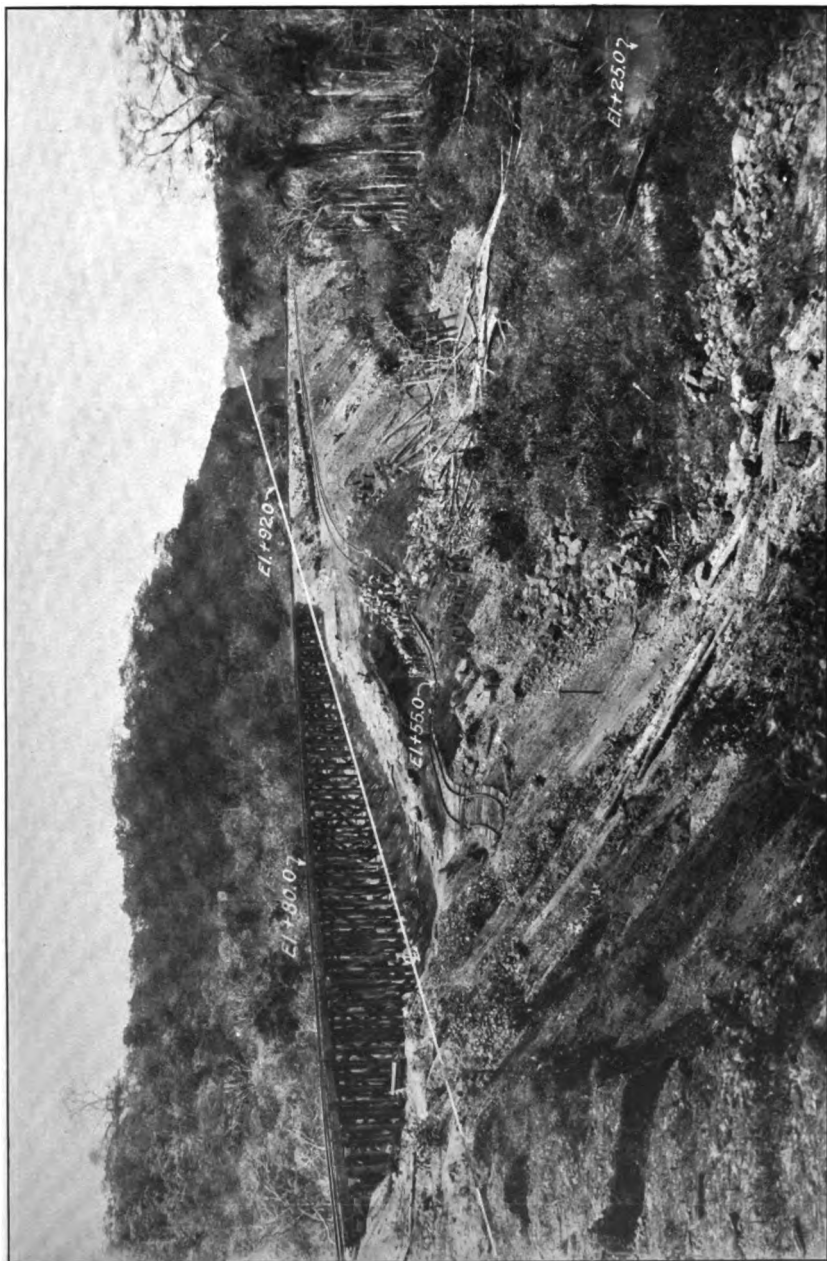
RELOCATION PANAMA RAILROAD. THE QUEBRANCHA BOTTOM, LOOKING NORTH, JUNE, 1911.  
Note the slope stakes on the west toe, 2:1 slope from 40-foot roadbed, leaving a heavy counterweight beyond the toe.





RELOCATION PANAMA RAILROAD. THE BRAZOS BOTTOM, LOOKING NORTH. FIRST DECK OF FILL NEARLY COMPLETED, MARCH, 1911.





RELOCATION PANAMA RAILROAD. THE QUEBRADA BAJA, LOOKING NORTH. WIDENING TOE OF FILL TO PREVENT SETTLEMENT, MARCH, 1911.

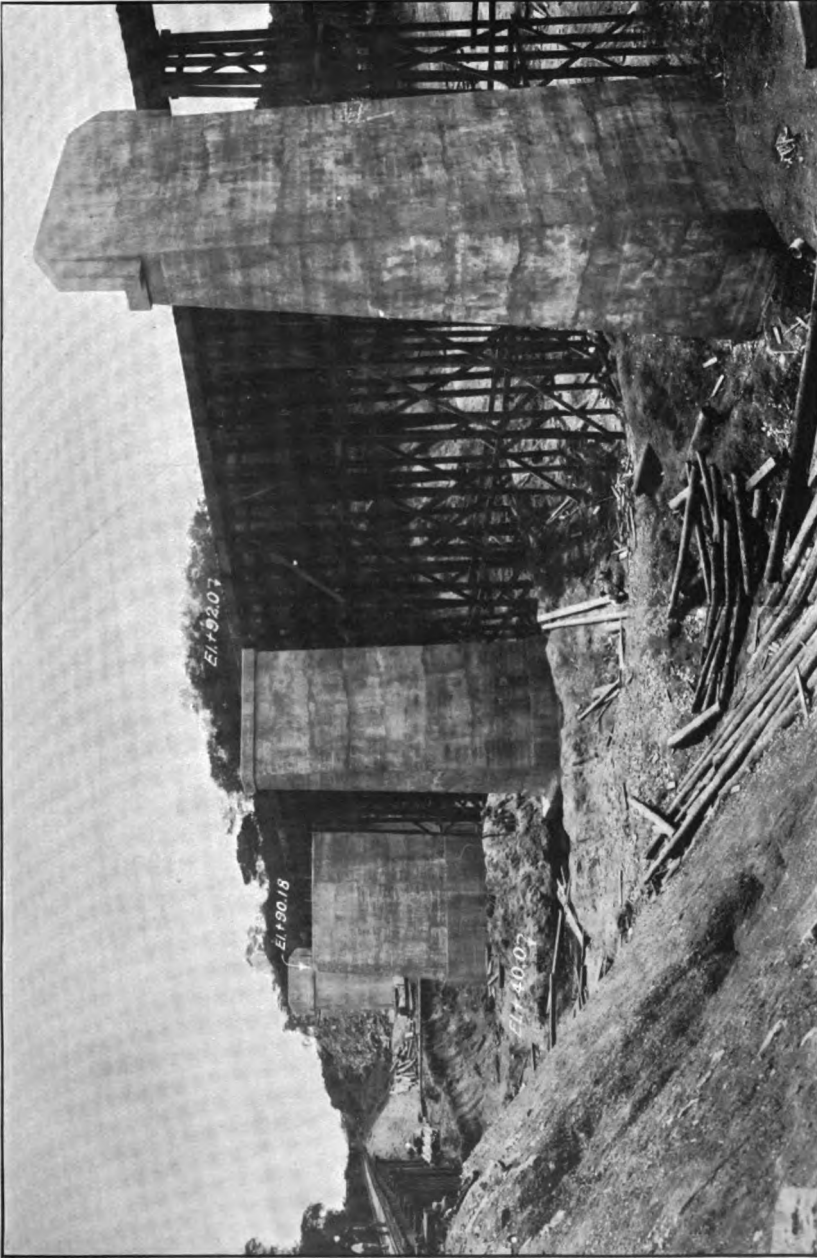






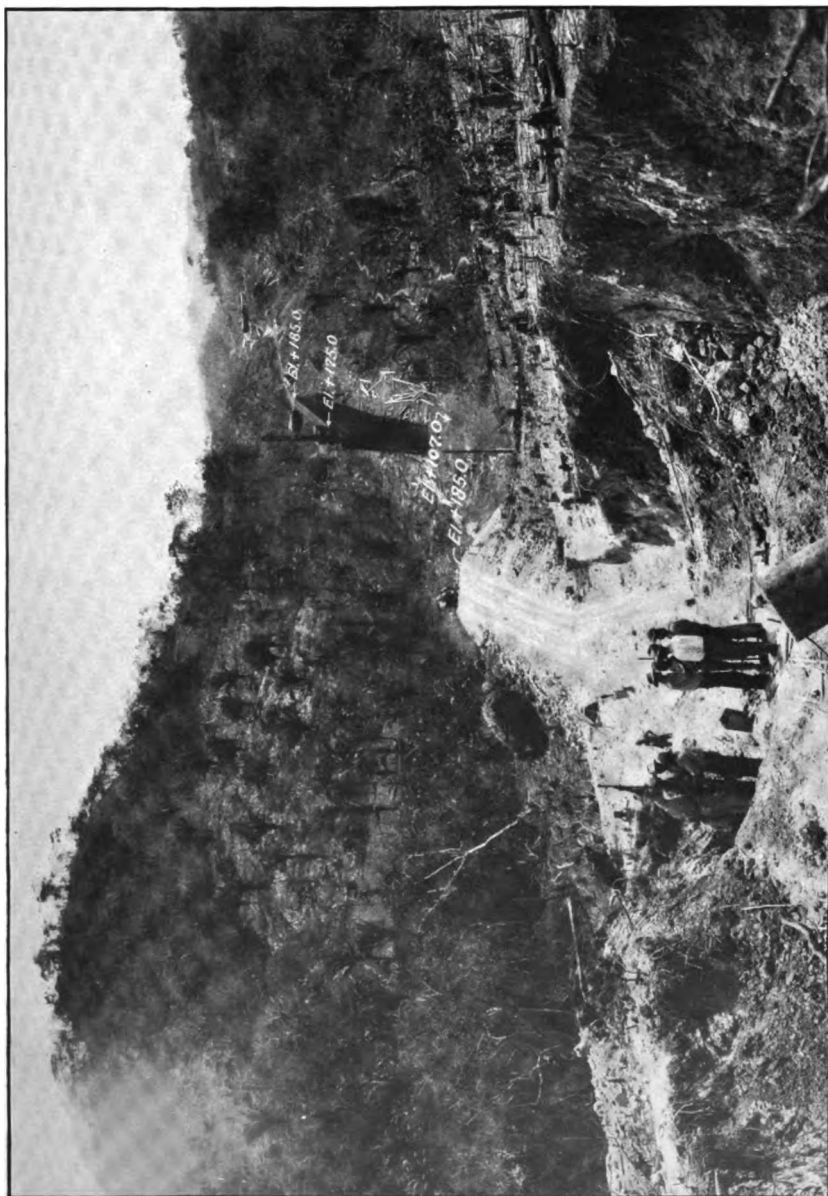
RELOCATION PANAMA RAILROAD. THE QUEBRADA BAJA, LOOKING NORTH, JUNE, 1911.





RELOCATION PANAMA RAILROAD. REINFORCED CONCRETE PIERS FOR BASCULE BRIDGE OVER GATUN RIVER, MARCH, 1911.





RELOCATION PANAMA RAILROAD, GOLD HILL LINE, TRESTLE ACROSS DEEP VALLEY BACK OF PARAISO, LOOKING SOUTH, HIGHEST BENT 77 FEET. YARDAGE IN FILL 230,000, MARCH, 1911.





RELOCATION PANAMA RAILROAD. GOLD HILL LINE. TEMPORARY TRESTLE 40 FEET HIGH, STATION 1790, ALONG THE BANK OF THE PEDRO MIGUEL RIVER.

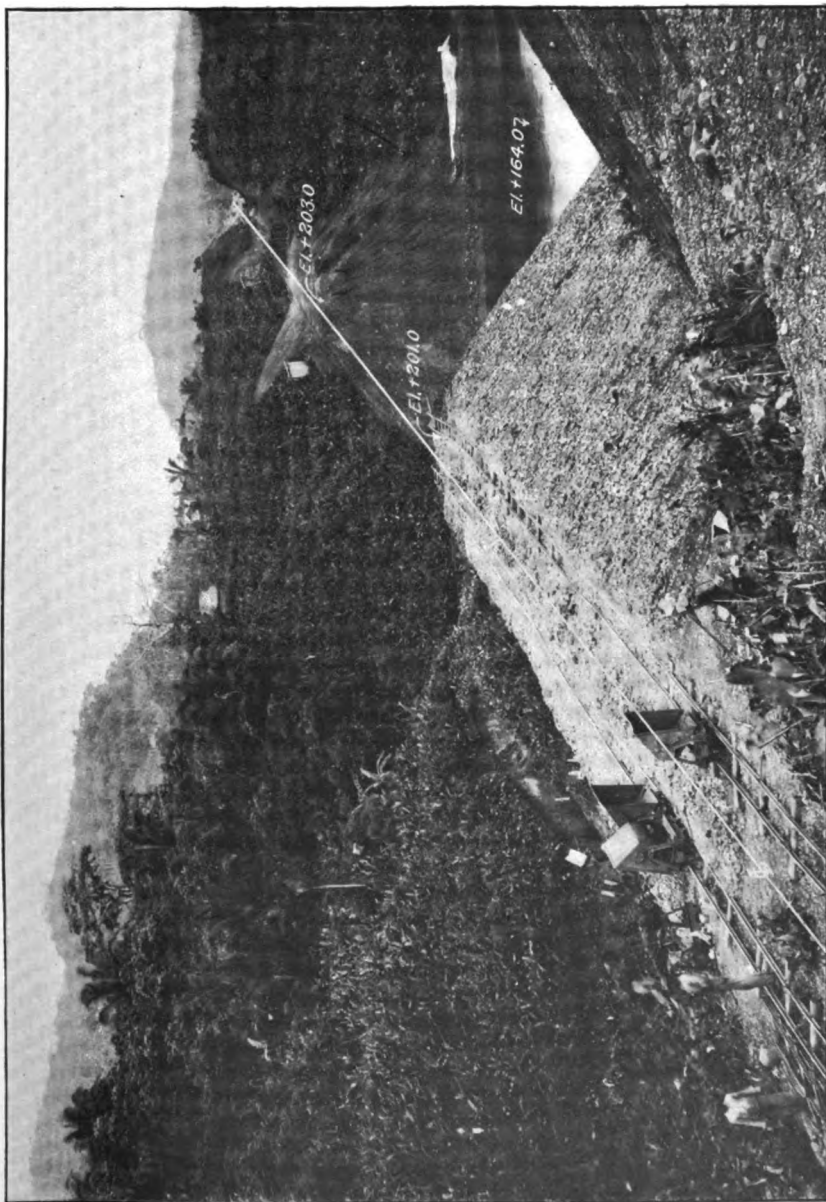






RELOCATION PANAMA RAILROAD. GOLD HILL LINE. LOOKING UP THE PEDRO MIGUEL VALLEY, SHOWING  
HEAVY PAN-CAR WORK, MARCH, 1911.





RELOCATION PANAMA RAILROAD. GOLD HILL LINE. LOOKING SOUTH FROM CONTRACTOR'S CUT, STATION 1464, JUNE, 1911.



## APPENDIX F.

### REPORT OF CIVIL ENGINEER H. H. ROUSSEAU, UNITED STATES NAVY, MEMBER OF ISTHMIAN CANAL COMMISSION, ASSIST- ANT TO THE CHIEF ENGINEER, IN CHARGE OF THE SECOND DIVISION OF THE OFFICE OF THE CHIEF ENGINEER.

ISTHMIAN CANAL COMMISSION,  
OFFICE OF THE CHIEF ENGINEER, SECOND DIVISION,  
*Culebra, Canal Zone, August 1, 1911.*

SIR: In compliance with your order of June 16, 1911, I have the honor to submit the following report covering the second division of the office of the chairman and chief engineer for the fiscal year ended June 30, 1911:

The total specific appropriations by Congress available to June 30, 1911, amounted to \$248,001,468.58, or 66 per cent of the total estimate of December, 1908, of \$375,201,000. By act approved March 4, 1911, additional appropriations were made for the fiscal year 1912 amounting to \$45,560,000, exclusive of fortifications, leaving \$81,639,531.42 of the total estimated cost of the canal to be appropriated hereafter, or about 22 per cent.

To June 30, 1911, the classified expenditures, i. e., expenditures under general account No. 1, which have been charged into the work, amounted to \$225,470,053.26, or about 60 per cent of the total estimate. Of this latter amount \$33,048,607.97 were expended during the fiscal year 1911, or 8.8 per cent of the total estimated cost of the canal. The difference between the appropriations available to June 30, 1911, and the classified expenditures to June 30, 1911, amounting to \$22,531,415.32, represents such items as unexpended balances in appropriations, unexpended material and supplies in storehouses, and other items reported as "Unclassified expenditures," under general accounts other than general account No. 1, which are not yet properly chargeable against construction work. They are listed in Table No. 2 of the examiner of accounts' annual report.

The quantity of work performed to June 30, 1911, for the three principal items of excavation, concrete, and fill in dams, the total estimated amounts, and the amount performed during the fiscal year 1911, are as follows:

Items of work.	Estimated total quantity.	Completed to June 30, 1911.		Performed during fiscal year 1911.	
		Quantity.	Per cent of total.	Quantity.	Per cent of total.
<b>Excavation:</b>	<i>Cubic yards.</i>	<i>Cubic yards.</i>		<i>Cubic yards.</i>	
Dry.....	117,234,385	88,915,520	75.84	20,266,574	17.29
Wet.....	86,118,874	53,954,690	62.65	11,936,972	13.86
<b>Total.....</b>	<b>203,353,259</b>	<b>152,870,210</b>	<b>70.26</b>	<b>32,203,546</b>	<b>15.84</b>
<b>Concrete.....</b>	<b>4,545,879</b>	<b>2,509,326</b>	<b>55.20</b>	<b>1,742,928</b>	<b>38.34</b>
<b>Fill in dams.....</b>	<b>23,598,660</b>	<b>16,678,660</b>	<b>70.68</b>	<b>7,295,827</b>	<b>30.92</b>

The accompanying chart (Pl. 119) shows graphically the excavation, concrete, and fill, and the total expenditures to June 30, 1911. The chart shows graphically the monthly rate of progress of the work and

expenditures. The curves begin at the point indicating the total amount of work to be done, or the total estimated cost. The ordinates of the curves, reading from the zero line, which is at the top, when referred to the proper scale on the left, show the amount of work remaining to be done, or the unexpended balance of the estimated cost; as, for example, if it is desired to find the estimated cost of the work still to be done on June 1, 1909, find this date on the top line, follow the vertical line until curve No. 18 is reached; from this point follow a horizontal line to intersect the proper scale on the left.

Of the total classified expenditures to June 30, 1911, \$27,580,724.37 were for plant and equipment for construction, of which amount \$626,330.86 were expended during the fiscal year 1911.

The principal units of plant and equipment in use on July 1, 1911, both afloat and ashore, by the commission and Panama Railroad Co., are given in the following tables:

TABLE A.—Statement of rolling stock owned by the Isthmian Canal Commission in use by the different departments, as of July 1, 1911.

Description.	Atlantic division.	Central division.	Pacific division.	Panama R. R.	Panama R. R. relocation.	Office of chief engineer.	Quartermaster's department.	Disbursing office.	Mechanical division.	Total.
<b>Cars:</b>										
50-ton steel, flat	26	45	26	397	2		20			516
40-ton wood, flat, "Lidgerwood"	23	1,629	13						1	1,666
Wood, flat					1					1
Narrow-gauge, flat—										
3-foot gauge	44									44
34-foot gauge	20		32							52
Decauville, flat, 1-meter gauge	88	118								206
12-yard western dump	59	209	194	4	125					501
18-yard western dump	103	177								280
4-yard dump, 3-foot gauge	34									34
6-yard dump, 34-foot gauge	75									75
12-yard Oliver dump	33	245	159		162					599
18-yard Oliver dump	48	202	50		8					308
Goodwin dump		12								12
Ingoldsby dump		12								12
Pay car								1		1
Pay-certificate car		1								1
Electric-automatic railway, Gatun handling plant	45									45
Cranes (various)	22	7	10		3		7		6	55
<b>Locomotives:</b>										
201-class, American Locomotive Works	7	84	8		1					100
301-class, Baldwin Locomotive Works	7	20	12		1					40
400-class	8	1	3		3				1	16
500-class	6	10	16		8				1	41
600-class		20								20
700-class	8	3	11		3					25
800-class (34-foot gauge)	21		12							33
American 8-wheel		2								2
Decauville, 1-meter gauge	2	2			4					8
Special									1	1
Electric industrial railway, Gatun handling plant	12									12
Motor cars	1	1	1		2	3				8
Velocipedes			1							1
<b>Steam shovels:</b>										
Model 20 Marion					1					1
Model 60 Marion		1	2							3
Model 91 Marion	1	8	3		3					15
45-ton Bucyrus	1	2	2		1					6
70-ton Bucyrus	12	9	6		7					34
95-ton Bucyrus		32								32
Type 1, Thew			1							1
Spreaders	3	12	5		5					25
Unloaders	1	24	1		1					27
Track shifters	3	4	2		1					10
Pile drivers	8	3	4		2					17

TABLE B.—Statement of floating equipment in use by the different departments, as of July 1, 1911.

Description.	Atlantic division.	Pacific division.	Quarter-master's department.	Sanitary department.	Civil administration department.	Total.
<b>Barges:</b>						
Cement.....	6	.....	.....	.....	.....	6
Coal.....	6	2	.....	.....	.....	8
Coal, o. f. s.....	1	.....	.....	.....	.....	1
House boat.....	2	1	.....	.....	.....	3
Mud dump.....	10	7	.....	.....	.....	17
Stone and sand.....	.....	6	.....	.....	.....	6
Steel dump.....	.....	4	.....	.....	.....	4
Rock drill.....	1	1	.....	.....	.....	2
Steel.....	18	.....	.....	.....	.....	18
Rock breaker.....	.....	1	.....	.....	.....	1
Wrecking.....	.....	1	.....	.....	.....	1
Disinfecting.....	.....	.....	.....	1	.....	1
Oil.....	.....	1	.....	.....	.....	1
Coal hoist.....	.....	1	.....	.....	.....	1
Machine shop.....	.....	1	.....	.....	.....	1
Water.....	.....	1	.....	.....	.....	1
Self-dumping wooden.....	1	.....	.....	.....	.....	1
Floating pump (concrete).....	.....	3	.....	.....	.....	3
Clapnets.....	4	7	.....	.....	.....	11
Gasoline launches.....	6	5	1	1	1	14
Steam launches.....	2	6	.....	.....	.....	8
<b>Dredges:</b>						
Sea-going suction.....	1	1	.....	.....	.....	2
Dipper.....	2	1	.....	.....	.....	3
Ladder.....	3	4	.....	.....	.....	7
Pipe line.....	7	.....	.....	.....	.....	7
Double-end clam-shell.....	1	.....	.....	.....	.....	1
Steam cutters.....	1	1	.....	1	.....	3
<b>Tugs:</b>						
First class.....	6	3	.....	.....	.....	9
Second class.....	2	.....	.....	1	.....	3
Floating pile driver.....	1	1	.....	.....	.....	2
Floating crane.....	1	.....	.....	.....	.....	1
Towboat, stern wheel.....	1	.....	.....	.....	.....	1

TABLE C.—Statement of equipment owned by and operated on the main line of the Panama Railroad Co., as of July 1, 1911.

ROLLING EQUIPMENT.

<b>Locomotives:</b>		<b>Freight cars:</b>	
Road engines.....	36	Box cars.....	813
Switch engines.....	22	Coal cars.....	39
Engines in Isthmian Canal Commission's service.....	6	Flat cars.....	15
		Fast-freight cars.....	19
<b>Total.....</b>	<b>64</b>	<b>Total.....</b>	<b>886</b>
<b>Passenger cars:</b>		<b>Miscellaneous:</b>	
Special cars.....	4	Caboose.....	16
First-class cars.....	22	Specie cars.....	2
Second-class cars.....	22	Water-tank cars.....	3
Baggage cars.....	2	Stock cars.....	20
Baggage and mail cars.....	6	Rodger ballast cars.....	196
Hospital cars.....	2	Outfit cars.....	205
Local express cars.....	3	Pile drivers (steam).....	2
<b>Total.....</b>	<b>61</b>	10-ton crane.....	1
		25-ton cranes.....	2
		Refrigerator cars.....	22
		Ditcher (steam).....	1

FLOATING EQUIPMENT.

Tugs.....	2	Cargo lighters.....	8
Pilot boat, 40-horsepower.....	1	Coal lighters.....	5
Floating pile driver.....	1	Gasoline launch, 12-horsepower.....	1

The disposition of surplus plant and equipment upon the completion of construction work so as to bring the greatest reimbursement to canal appropriations is a matter of growing importance. The policy of the commission during the construction period has been to



keep all machinery, plant, and equipment in the best possible condition, both on the ground of economy and for efficiency, and after an average use of not much more than five years, at even 10 per cent depreciation a year, it should have a value fully half of its original cost. The prices which will be obtained from actual sale can not be foretold. The gauge of all rolling stock and equipment used on the standard 5-foot Isthmian tracks will have to be changed to the standard 4-foot, 8½-inch gauge in the United States. This possibility was taken into consideration on practically all equipment ordered after 1906, and the change can be made with little difficulty and expense. To change the gauge of locomotives will cost about \$250 apiece, or 2½ per cent of their original cost.

Up to the close of the fiscal year 1911, little or no plant and equipment had been permanently tied up, and it will be another year before any considerable number of the different units will be available for sale, which will permit from two to three years being taken to gradually dispose of the old plant before the canal is opened for traffic. A certain proportion of the plant, including rolling stock, equipment, and excavating machinery, will naturally be reserved on the Isthmus indefinitely to take care of maintenance work and any future requirements. This amount could be reduced gradually after the canal has been operated a year or two. The best of the shop tools and machinery will be reserved for the permanent shops. There will be left about 150 large American mogul engines, weighing, with tender, from 105 to 117 tons each, in excellent condition, available for sale, and over 1,500 steel dump cars, weighing from 16 to 22 tons each. The cars of wooden construction will probably not bear transportation back to the United States intact on account of the deterioration of the wood. The metal parts will be useful in rebuilding cars in the United States. A good deal of the marine equipment will be useful in the maintenance and operation of the canal after completion, including tugs, barges, and some dredges. It is not believed that the condition of the seven old French and Belgian ladder dredges, which are being used on the canal, will, at the end of the work, warrant their transportation to the United States for further work.

The construction work requires that all mechanical appliances of every character be kept in thorough repair so that they can be operated, without breakdown, at their highest efficiency during working hours. This necessitates a suitable organization and proper facilities for the inspection, maintenance, and repair of all mechanical appliances. In general, the operators or users of mechanical equipment are held responsible for its satisfactory performance and for reporting promptly any repairs necessary. For some classes of equipment, such as cars, there are special inspectors who make frequent examinations. For other classes of equipment, such as locomotives, there are inspectors, called traveling engineers, who not only report mechanical defects, but also supervise and instruct engineers in respect to the manner of handling such equipment and the consumption of lubricants thereon, and firemen in regard to the method of firing and the consumption of fuel.

All repairs are performed either on the work or in the shops provided at convenient points along the line of the canal. Certain of these shops are under the jurisdiction and control of the respective division heads, including the marine shops at Cristobal and Balboa,

the steam-shovel repair shop at Empire, the Cristobal car-repair shop of the Panama Railroad Co., and the detached repair shops at Porto Bello and Toro Point. In addition, there is a central manufacturing and repair shop at Gorgona, which, with its subordinate outlying shops and engine houses at Pedro Miguel, Las Cascadas, and Gamboa, comprises the mechanical division, which is placed directly under the chief engineer's office.

All shops of both the commission and Panama Railroad Co. are under the general supervision of the inspector of shops, along the lines of securing the most efficient management, inspecting, and recommending the most economical distribution of work, employees, and tools among the different shops, and the adoption of standard methods therein. This, while it leaves the control of the operation of some of the mechanical work directly under the different division heads, at the same time insures the requisite coordination and cooperation between all shops and all mechanical work on the Isthmus.

On June 30, 1911, the number of shop employees was 4,405, of which 1,532 were gold employees. The gold shop employees number about 25 per cent of the total number of gold employees on the Isthmus. The total pay roll for all shops for June was a little over \$275,000.

During the year heavy repair work and all manufacturing work so far as practicable has been concentrated at Gorgona shops. This, in connection with the transfer of some work to the Cristobal dry-dock shops, has enabled the metal-working shops of the Panama Railroad Co. at Cristobal to be entirely closed and a considerable saving made.

The details of what has been accomplished during the fiscal year covered by this report in the different shops are given in the report of Maj. T. C. Dickson, Ordnance Department, United States Army, inspector of shops, which is attached hereto marked as an appendix.

According to the present program of work it is proposed to retain the Gorgona shops until the rising waters of Gatun Lake flood it out at about elevation +70.

By that time the manufacturing and repair work, especially in connection with locomotives, cars, and excavating machinery, will have very largely diminished, and the permanent shops at Balboa will be prepared to take over whatever work is necessary after the Gorgona shops are closed. With the Panama Railroad machine and other metal-working shops at Cristobal which, while at present closed, have not been dismantled, the large repair shops at Empire, which will have rail connection with all parts of the work until the canal is opened for traffic, and the marine shops at Cristobal and Balboa, it is believed that the transfer and consolidation of all repair facilities at Balboa, which have been approved, can be made with a minimum of inconvenience and delay.

The past fiscal year has not been marked by any serious labor disturbances in the shops. For some time the hourly gold employees, over four-fifths of whom are employed at the various shops, have been endeavoring to secure the same leave with pay privileges as the gold monthly employees. The hourly employees are paid for all overtime; the monthly employees receive no extra compensation. In September, 1909, the Secretary of War granted hourly gold employees two weeks' leave with pay each year, effective January 1, 1910. In November, 1910, President Taft, while on the Isthmus,

gave several delegations of hourly gold employees employed in the shops hearings on their application for either an increase in pay or additional leave of absence each year with pay, and on his return to the United States authorized, effective January 1, 1911, the granting to hourly gold employees of four weeks' leave of absence with pay per annum, with privilege to accumulate their leave with pay to not over eight weeks, which, with their overtime pay, puts them on practically the same basis as regards leave privileges as the monthly gold employees. Before this decision was announced, the boiler makers on the Isthmus resigned almost in a body and went back to the United States, 177 taking this action during November and December, 1910. The action of these men was not sustained by the boiler makers' federation in the United States, and their places were filled with very little inconvenience or delay.

The wage scale has remained at 65 cents an hour for first-class mechanics, and during the last half of the fiscal year labor conditions were satisfactory. The force of shop mechanics is one of the most unstable of the different classes of gold employees. At the latter part of the year there were about 1,200 hourly gold mechanics employed by the commission. During the year there were employed in the United States and on the Isthmus the following number of hourly gold mechanics:

Ratings.	Number employed during fiscal year 1911.			Number on rolls July, 1911.
	In United States.	On Isthmus.	Total.	
65 cents an hour.....	493	194	687	804
56 cents an hour.....	62	78	140	210
44 cents an hour.....	4	193	197	112
At other ratings.....	0	108	108	77
Total.....	559	573	1,132	1,203

From the foregoing it is seen that the number of hourly gold employees taken on during the year is about 94 per cent of the total number on the rolls at present, which means that the average length of employment of gold shop mechanics on the Isthmus is about only one year.

During the past year consideration has been given to the general matter of furnishing certain facilities required for use after the completion of the canal and in connection with the operation thereof, such as the storing and furnishing of coal and other fuel for all purposes, both afloat and ashore, the construction of a dry dock capable of taking any vessel that can pass through the canal, and the furnishing of adequate and convenient facilities for the repair of all vessels, as well as of all rolling stock, equipment, and machinery ashore. A board which was appointed to consider and report on this matter, under date of April 24, 1911, on which the different interests concerned were represented, submitted the following recommendations on May 15, 1911, which were approved:

1. That duplicate and separate facilities for naval vessels and for commercial vessels are not necessary and should not be provided, it being understood that the facilities furnished will be sufficient for the joint use of all vessels requiring them in time of peace, and that in time of war they may be reserved exclusively for military use.

2. That coaling facilities should be provided near each entrance to the canal.
3. That the principal coaling station should be on the Atlantic side, with a smaller plant on the Pacific side.
4. That facilities for storing 200,000 tons of coal, with a maximum increase of 50 per cent, be provided on the Atlantic side, and facilities for storing 50,000 tons of coal, with an increase of at least 100 per cent, be provided on the Pacific side.
5. That the dry dock and other repair facilities should be located near the Pacific entrance to the canal.
6. That one dry dock capable of accommodating the largest vessel that can pass through the canal should be built in connection with the Pacific terminal, and that a convenient and sufficient area should be reserved for the construction of a smaller dry dock if it should be found that same is required in the future.
7. That two marine railways should be built in connection with the Pacific terminal and that a convenient and sufficient area should be reserved for the construction of two additional marine railways if same should be required in the future.
8. That 5,000 linear feet of dock frontage should be provided at the Pacific terminal exclusive of coaling docks, but inclusive of 1,000 linear feet for repair docks, and that a convenient and sufficient area should be reserved for any necessary extension of the water frontage that might be required in the future.
9. That an area of about 45 acres should be reserved at the Pacific terminal for repair shops, shopyards, and for the storage of material and supplies, to be located conveniently to the dry docks and to the berths to which vessels undergoing repairs would be assigned, and that the shops and accessories should be so located and arranged as to not interfere with the use of the docks for commercial purposes.
10. That floating crane capacity should be provided in connection with other repair facilities with a total lifting capacity of not less than 250 tons, sufficient to unstep and step the heaviest of the lock-gate leaves.
11. That the coal dock to be built at the Pacific terminal should have a usable frontage of about 1,000 feet.
12. That facilities for supplying fresh water should be installed at all docks.
13. That the choice for the site of a coaling plant at the Atlantic terminal lies between the north point of the island opposite Dock 11, Cristobal, and the present location of Dock 13.
14. That the two locations specified in the previous recommendation should be carefully investigated to determine the relative economy of installation and operation, and convenience as to use, and that in these investigations there be kept in view both the necessity of providing a channel of access sufficiently commodious for large vessels, and the practicability of receiving suitable railway connection.
15. That the coal dock to be built at the Atlantic terminal should have a usable front of not less than 2,000 feet.
16. That adequate facilities for supplying fuel oil to shipping should be provided at the coal docks at both terminals.
17. That storage capacity for fuel oil of approximately 80,000 barrels should be provided at each terminal, with space for any additional storage that may be required in the future.
18. That about 4,000 feet of permanent dock frontage for commercial use should be provided at the Atlantic terminal and that provision should be made for any necessary expansion that may be required in the future.
19. That the quartermaster's storehouse facilities at Mount Hope and at Dock 14 in connection therewith should be continued as at present, and that a storehouse of sufficient capacity should be constructed at the Pacific terminal, conveniently located, to provide for the shops at that point.
20. That in order to provide moderate repair facilities which will be required permanently at the Atlantic terminal the Cristobal dry dock and the necessary accessory repair facilities should be continued in use for that purpose.
21. That the best location for the larger dry dock at the Pacific terminal is near the foot of the northwest slope of Sosa Hill, the axis of the dock to have a general north-easterly direction, the exact position of the dock to be determined from consideration of local foundation explorations to be made hereafter.
22. That the location for the docks and piers for commercial use should be in a general direction north of Sosa Hill, and that the exact arrangement of the proposed ships basin and adjoining piers—that is, whether parallel to or inclined to the axis of the canal—should be determined from consideration of borings and estimates of cost to be made hereafter.
23. That, since the position of the coaling facilities at the Pacific terminal is dependent in a degree upon the general layout of the commercial and repair docks and accessory facilities, recommendation as to the exact location of the same should be deferred for consideration and decision after the borings and other data covered by the two

previous recommendations have been completed and a decision made on the matters covered therein.

24. That the chairman of the Isthmian Canal Commission and president of the Panama Railroad Co. be requested to authorize the exploration work to be undertaken which is recommended in the preceding recommendations.

In fixing the principal repair and docking facilities on the Pacific side the decision was largely influenced by the views and wishes of the Navy Department. At the end of the year all exploration work recommended by the board had not been completed; the indications were, however, that satisfactory locations as regards size and supporting material for both the coaling plant on the Atlantic side and the dry dock and repair shops on the Pacific side could be obtained in the general areas recommended, and it is expected that during the fiscal year 1912 the plans for these accessory facilities will be completed, so that the construction of the same may be taken up as soon as the work shall be authorized and the plant necessary therefor can be released from canal construction work.

Constant effort has been made during the year by all concerned to reduce the cost of repairs to equipment, as well as the cost of the operation and maintenance thereof, through the introduction of improved methods of supervision and by enlisting the interest of those concerned in securing as great a degree of economy as practicable. The total cost of repairs to equipment in continuous service and the cost of repairs per service day during the year ended June 30, 1911, and similar information for the last six months of the previous fiscal year is given in the following table:

Items of equipment.	Six months ended June 30, 1910.			Fiscal year 1911.		
	Service days.	Total expense.	Average cost per service day.	Service days.	Total expense.	Average cost per service day.
Locomotives.....	31,955	\$221,760.01	\$6.94	63,926	\$504,008.10	\$7.88
Steam shovels.....	9,527	263,550.54	27.66	21,775	483,536.88	22.21
Unloaders.....	1,655	34,015.34	20.55	3,417	50,564.45	14.80
Spreaders.....	1,127	19,496.48	17.30	2,290	33,815.41	14.77
Track shifters.....	798	5,326.12	6.67	1,170	2,632.84	2.25
Locomotive cranes.....	3,075	11,684.20	3.80	5,851	43,502.39	7.44
Pile drivers.....	442	4,165.78	9.42	1,173	6,676.15	5.69
Unloading plows.....	1,655	6,267.61	3.79	3,417	11,291.45	3.30

The total cost of car repairs, all classes, for the same period was \$894,496.55, or an average of \$0.8656 per car per working day, as compared with a total cost of all car repairs for the six months ended June 30, 1910, of \$479,165.75, or an average of \$1.03 per car per working day.

The large decrease in the cost of repairs accomplished during the year speaks for itself. The increase in the cost of locomotive repairs was due to a combination of an unusually large amount of general repairs and repairs due to casualties.

Electric current for lighting and power is generated at five stations on the Isthmus located at Balboa, Miraflores, Empire, Gorgona, and Gatun. The output of the Gatun and Miraflores plants is largely used in construction work in the Atlantic and Pacific divisions, respectively. The current generated and the cost per kilowatt hour for the different plants for the fiscal year ended June 30, 1911, is given in the following table the unit cost in the case of the Balboa,

Empire, and Gorgona plants including line construction and maintenance and maintenance of lights, fuses, and wiring in buildings, but in the case of the Gatun and Miraflores plants being the cost of current delivered at the switchboard only:

Locations of plants.	Kilowatt hours.	Expenses.	Cost per kilowatt hour.
Balboa <sup>1</sup> .....	1,404,475	\$57,150.02	\$0.04069
Empire <sup>1</sup> .....	2,514,710	73,744.98	.02933
Gorgona <sup>1</sup> .....	867,149	37,558.02	.04331
Miraflores <sup>2</sup> .....	6,797,714	186,532.15	.02744
Gatun <sup>3</sup> .....	12,962,247	293,825.56	.02267
Total.....	24,546,295	648,810.73	.02643

<sup>1</sup> Original cost of these plants has been charged to divisions on basis of benefits received. The product is invoiced to departments and divisions at a price that provides for renewals and new machinery.

<sup>2</sup> Includes \$0.01 per kilowatt hour to absorb cost of plant.

<sup>3</sup> Includes \$0.011 per kilowatt hour to absorb cost of plant.

Oil is used as fuel in all of these stations. Current is generated at the plants at Miraflores and Gatun by steam turbines; at the Empire and Gorgona plants by noncondensing engines; and at the Balboa plant by condensing engines.

The principal air-compressor plants are located at Las Cascadas, Empire, Rio Grande, and Balboa, and furnish compressed air to the Central and Pacific divisions and the work along the "high line" around Gold Hill on the relocation of the Panama Railroad. The amount of air compressed during the year and the cost at each station is shown in the following table:

Locations of plants.	Output.	Total cost.	Cost per 1,000 cubic feet.
	<i>Cubic feet.</i>		
Las Cascadas.....	1,512,594,874	\$46,439.08	\$0.0307
Empire.....	4,483,713,554	149,448.06	.0333
Rio Grande.....	1,773,887,622	55,890.62	.0315
Balboa.....	491,003,491	15,757.32	.0321
Total.....	8,261,199,541	267,535.08	.0324

For the 12 months ended June 30, 1911, the average cost of maintaining plant and equipment per unit of work accomplished, as compared with the average cost for the last six months of the previous fiscal year, was as follows:

Items of work.	Fiscal year 1911.			Average cost of repairs per unit for six months ended June 30, 1910.
	Amount of work accomplished.	Total cost of repairs.	Average cost of repairs per unit.	
<b>Excavation:</b>	<i>Cubic yds.</i>			
Dry.....	20,266,574	\$1,759,565.26	\$0.0868	\$0.0795
Wet.....	11,936,972	571,907.03	.0479	.0715
Concrete.....	1,742,928	359,290.88	.2061	.1741
Sand.....	936,760	228,928.47	.2444	.2789
Stone.....	1,719,857	432,256.51	.2513	.2410
<b>Fill:</b>				
Dry.....	3,019,036	93,376.40	.0309	.0065
Wet.....	4,276,791	115,329.02	.0270	.0587

In addition to lessened cost of repairs, economy in operation and maintenance has been secured through the cooperation of all concerned by reducing steam consumption through the more economical operation of the different units and by an appreciable saving in fuel, lubricants, and other similar supplies. At the beginning of the fiscal year an additional traveling engineer was appointed to have supervision over fuel and oil consumption to supplement the work of the other two traveling engineers whose jurisdiction extended to locomotives only. His work covered steam shovels, unloaders, spreaders, and all stationary plants, and has since been extended to marine equipment with very satisfying results.

The Isthmian Canal Commission and the Panama Railroad Co. are using together at present about 35,000 tons of coal per month, which at an estimated cost of \$6 per ton delivered into the fire box amounts to \$210,000 per month. In addition about 75,000 barrels of fuel oil, at \$1.10 per barrel, are being used, amounting to \$82,500 per month. The cost of lubricating and illuminating oils, greases, and waste is over \$5,000 per month, making a total approximate cost for fuel, lubricating, and illuminating oils, etc., of about \$3,600,000 per annum. A saving of 10 per cent of this amount would be \$360,000 per annum, or about \$1,000 per calendar day. A table follows showing the consumption of fuel, both coal and oil, by the commission and Panama Railroad Co. for the last three years:

*Statement of fuel consumed by Isthmian Canal Commission and Panama Railroad Co.*

	Fiscal year 1908-9.				Fiscal year 1909-10.			
	Coal.	Oil.		Total.	Coal.	Oil.		Total.
		Quantity.	Equivalent in coal.			Quantity.	Equivalent in coal.	
Isthmian Canal Commission.....	<i>Tons.</i> 260,270	<i>Barrels.</i> 290,958	<i>Tons.</i> 72,740	333,010	<i>Tons.</i> 265,329	<i>Barrels.</i> 463,186	<i>Tons.</i> 115,797	481,126
Panama Railroad Co. ....	32,336	.....	16,056	48,392	33,390	.....	25,495	58,885
Total.....	292,606	.....	88,796	381,402	398,719	.....	141,292	540,011

	Fiscal year 1910-11.			
	Coal.	Oil.		Total.
		Quantity.	Equivalent in coal.	
Isthmian Canal Commission.....	<i>Tons.</i> 364,403	<i>Barrels.</i> 679,928	<i>Tons.</i> 169,982	534,385
Panama Railroad Co. ....	50,796	104,714	26,178	76,974
Total.....	415,199	784,642	196,160	611,359

NOTE.—Four barrels of oil assumed to equal 1 ton of coal.

It has been found by actual trials that there are very few installations on the Isthmus where one of the traveling engineers can not, when firing himself, make a saving in fuel consumption of considerably more than 10 per cent, as compared with the work of the regu-

lar fireman, and the present efforts of the traveling engineers are being directed to securing this saving by personal instruction in firing.

A system has been established of training firemen, especially for locomotives, so that they are required to qualify before being taken on as regular firemen. The breaking in of Spaniards as firemen has met with success.

The same work has been carried on to obtain economy in the use of fuel oil. To demonstrate the savings obtainable by correct firing, tests at the different plants have been made, showing the fuel consumption by the regular force for a period of 12 hours with that under the firing of the traveling engineer for a like period. The savings in all stationary plants have been considerable. For instance, at the Las Cascadas air-compressor plant the saving by this comparison was shown to be 3.5 per cent; at the Mount Hope pumping plant 22 per cent; at the Gorgona pumping plant 15 per cent; and at the Cucaracha pumping plant 11 per cent.

In connection with methods employed to secure economy, the fireroom forces at the different plants, including firemen, oilers, and helpers, have been standardized and reduced in number. All surplus tools and supplies being carried in the different small stationary plants have been required to be returned to store.

Considerable progress has been made during the year toward putting the consumption of lubricants on a satisfactory basis. Lubricating and illuminating oils and lubricating greases, which cost the commission and the Panama Railroad Co. a total of about \$137,500 in the fiscal year 1910, cost about \$80,600 only during the fiscal year 1911, a reduction of about \$57,000, or over 40 per cent. The reduction in the quantity of lubricating oil purchased was 16 per cent and of lubricating greases purchased 60 per cent. The reduction in the average cost of lubricating oil per gallon was 30 per cent and in the average cost of greases per pound 25 per cent.

This result was attained in spite of an increase in fuel consumption of about 13 per cent, which would naturally be accompanied by an increase in the use of lubricants. This saving was due principally to the following:

1. Reduction in the price paid for lubricating oils through the advantages of competition.
2. The obtaining of practically all oils in metal drums which are returned to the contractor when empty, thus eliminating the cost of barrels or tins in which oil had previously been shipped.
3. The substitution of cheaper lubricants for higher-priced lubricants; for instance, formerly engine oil was used for lubricating steam-shovel chains, then car oil was adopted, and at present satisfactory results are being obtained by using crude petroleum for this purpose at less than one-fourth the cost.
4. The placing of all equipment on a fixed daily or monthly lubricating oil allowance, and the close supervision of the consumption of the same by the traveling engineers.

The saving during the past year due to the first two items amounted to over \$30,000, and to the last two to over \$20,000.

The fact that the Isthmian Canal Commission and Panama Railroad Co. are lubricating their locomotives and cars cheaper than railroads in the United States is worthy of notice. Practically all the railroads in the United States are lubricated by one oil company, and their example was followed on the Isthmus at first, on account of the opinions advanced by canal employees formerly connected with railroads that no other oils would be found to answer the purpose



satisfactorily. During the past two years the commission and the Panama Railroad Co. have purchased all of their lubricants under an annual contract from one contractor who was the lowest responsible bidder. The specifications under which the contracts were made involved a wide departure from the usual practice in other branches of the Government service and in commercial practice in especially the following respects:

1. No attempt has been made to describe or limit the qualities of the different lubricants, the sole requirement being that the oils must be satisfactory for the purpose for which intended.
2. All lubricants must be recognized brands of experienced manufacturers.
3. The contractor must keep a representative on the Isthmus during the continuance of the contract to both supervise the use of the lubricants and to take prompt action in replacing any unsatisfactory oils delivered.

During the past two fiscal years and for the fiscal year 1912 annual contracts for lubricants have been awarded twice to the same firm and once to another company, neither of these firms being the company which lubricates practically all of the railroads in the United States, and during the continuance of these contracts the lubrication of railroad and other rolling stock and equipment has been very satisfactory as regards both the quality of the lubricants furnished and the low cost of the lubrication. It has been impossible to detect any difference in the service rendered by these lubricants as compared with the service rendered by the higher priced lubricants used prior to the time the commission inaugurated the policy of purchasing all lubricants under annual contract by competition.

At present the Panama Railroad Co.'s locomotives average about 53 miles per pint of valve oil costing 2.4375 cents delivered on the Isthmus, and about 23 miles per pint of engine oil costing 1.375 cents, making a total cost for lubricating a locomotive per 1,000 miles of about \$1.06. The locomotives of the commission are doing as well if not better. If railroads in the United States were able to equal these figures of cost of lubrication, making due allowance for service and for size of equipment, it would be to their very material advantage—a benefit they could very justly attribute as being derived from the construction of the Panama Canal.

The system of cost keeping which had been adopted has been continued during the year with such modifications as have been found necessary.

The following statement shows the details of expenditures for plant to June 30, 1910, and for the fiscal year 1911, the absorption of plant charges by construction work to date, and the balance remaining under plant accounts at the close of the fiscal year to be absorbed in the future:

## Statement of expenditures for plant and equipment.

	Debits.			Credit by arbitraries charged to work.				Balance to be absorbed after June 30, 1911.
	To June 30, 1909.	Fiscal year 1910.	Fiscal year 1911.	Total cost of plant.	To June 30, 1909.	Fiscal year 1910.	Fiscal year 1911.	Total.
<b>ATLANTIC DIVISION.</b>								
Dry excavation plant.....	\$196,507.74	\$9,763.99	\$235.45	\$206,537.18	\$121,431.87	\$34,225.06	\$25,062.64	\$190,709.57
Dredging excavation plant.....	1,711,184.35	306,187.06	128,398.12	2,145,770.13	949,709.75	311,231.45	362,126.96	1,463,109.15
Gatun dam and spillway plant.....	826,794.83	117,141.54	576,839.19	1,520,775.56	325,185.71	376,743.91	509,613.77	1,211,543.39
Gatun locks plant.....	1,067,054.39	947,060.82	405,445.17	2,409,560.38	360,226.79	442,244.09	862,846.06	1,665,322.94
Gatun power plant (permanent).....	194,462.88		1194,462.88					
Porto Bello rock plant.....	966,834.43	56,460.22	89,133.60	1,142,446.25	14,562.13	220,446.97	438,592.50	673,601.60
Nombre de Dios plant.....	235,973.20	160,068.80	26,172.56	422,234.56	4,588.68	65,032.80	209,461.04	279,102.52
Transportation plant.....	1,150,882.08	363,509.48	149,477.84	1,663,869.40	20,824.93	327,681.29	676,699.82	1,025,206.04
Colon breakwater plant.....	326,968.71	122,210.00	272,767.86	721,967.60			54,536.39	667,431.21
Total.....	6,666,663.61	2,062,442.51	1,454,076.94	10,233,133.06	1,666,573.86	1,777,625.57	3,178,932.17	6,613,131.60
<b>CENTRAL DIVISION.</b>								
Dry excavation plant.....	10,589,005.30	1101,412.26	1207,892.24	10,279,700.80	5,327,837.58	2,318,183.00	1,852,269.20	9,498,269.78
Masonry plant.....			8,758.00	8,758.00				
Total.....	10,589,005.30	1101,412.26	1199,134.24	10,288,458.80	5,327,837.58	2,318,183.00	1,852,269.20	9,498,269.78
<b>PACIFIC DIVISION.</b>								
Dry excavation plant.....	292,510.01	19,999.47	58,824.13	361,333.61	13,430.96	9,970.30	19,885.90	43,287.16
Dredging excavation plant.....	2,244,365.70	597,832.22	145,224.79	2,987,422.71	1,507,283.13	639,047.45	439,964.78	2,586,297.39
Pedro Miguel locks and dams plant.....	323,531.00	479,830.19	32,291.70	835,652.89	71,972.15	112,175.64	369,477.94	553,625.73
Miraflores locks and dams plant.....	465,899.06	460,729.49	318,808.63	1,245,437.18	181,612.13	58,914.77	212,176.68	452,703.58
Ancon rock plant.....	327,914.15	441,043.87	47,368.51	816,326.53		59,559.16	316,634.88	376,213.54
Chame sand plant.....	162,105.52	133,352.07	19,910.77	315,368.36		40,661.02	136,808.22	177,469.24
Miraflores power plant.....	218,934.91	274,663.99	3,902.33	497,561.23		7,532.08	96,138.68	103,690.76
Total.....	4,025,270.35	2,407,481.30	626,330.86	7,059,082.51	1,774,300.37	927,860.45	1,591,126.58	4,293,287.40
Grand total.....	21,310,939.26	4,368,511.55	1,861,273.56	27,560,724.37	8,766,711.81	5,023,669.02	6,622,327.95	20,404,708.78

1 Credit.

The cost of repairs to marine equipment of the Isthmian Canal Commission and the Panama Railroad Co. during the fiscal year is shown in the following table:

Items of equipment.	Quantities excavated.	Total cost of repairs.	Cost per cubic yard.	Cost per month per unit.
<b>ATLANTIC DIVISION.</b>				
Seagoing suction dredge:				
Caribbean <sup>1</sup> .....	Cubic yards. 3,375,771	\$54,217.80	\$0.0161	\$4,518.15
Dipper dredges:				
Mindl <sup>2</sup> .....	559,679	34,844.24	.0623	2,903.69
Chagres <sup>3</sup> .....	523,154	24,873.80	.0475	2,072.82
Total.....	1,082,833	59,718.04	.0551	2,488.26
Ladder dredges:				
No. 1.....	549,896	20,996.38	.0383	1,749.70
No. 5.....	263,612	32,426.20	.1230	2,702.19
No. 6.....	406,585	21,082.48	.0516	1,756.87
Total.....	1,221,092	74,505.15	.0610	2,069.59
Tugs:				
Bohio.....		21,109.23		1,759.12
Gatun.....		12,085.39		1,007.95
Empire.....		5,707.09		475.59
Porto Bello.....		8,152.78		679.40
Mariner.....		22,784.84		1,898.74
Reliance.....		27,547.81		2,295.65
De Lesseps.....		7,049.37		587.45
Exotic.....		11,960.05		996.67
Total.....		116,406.54		1,212.57
<b>PACIFIC DIVISION.</b>				
Seagoing suction dredge:				
Culebra.....	2,993,788	42,922.95	.0143	3,576.91
Dipper dredge:				
Cardenas.....	743,839	46,009.18	.0619	3,834.10
Ladder dredges:				
Marmot.....	1,380,687	25,984.86	.0188	2,165.41
Badger.....	989,130	24,620.02	.0249	2,061.67
Mole.....	237,896	21,809.92	.0917	1,817.49
Gopher <sup>4</sup> .....	494,841	9,036.37	.0183	753.03
Total.....	3,102,554	81,451.17	.0263	1,696.90
Tugs:				
Cocoll.....		23,042.70		1,920.22
Chame.....		6,284.28		523.69
Miraflores <sup>5</sup> .....		7,681.04		640.09
La Boca.....		5,758.03		479.86
Total.....		42,766.05		890.96

<sup>1</sup> There was credited to this account \$14,712 for parts returned to stock; credit not considered.

<sup>2</sup> There was credited to this account \$12,201 for parts returned to stock; credit not considered.

<sup>3</sup> There was credited to this account \$9,562 for parts returned to stock; credit not considered.

<sup>4</sup> Engaged in dredging sand at Chame.

<sup>5</sup> In service from Nov. 10, 1910.

The total amount and distribution of general administrative expenses and general expenses during the fiscal year to the three construction divisions, the departments of civil administration and sanitation, and the work of relocating the Panama Railroad Co. was as follows:

Statement of general administrative expenses and of general expenses for twelve months, June, 1910, to May, 1911, inclusive.

	Total.	Atlantic division.	Central division.	Pacific division.	Civil administration.	Sanitation.	Relocation of Panama R. R.
General administrative expenses <sup>1</sup> .....	\$396,342.56	\$130,196.33	\$67,418.71	\$98,727.52			
Miscellaneous general expenses:							
On the Isthmus <sup>2</sup> .....	90,628.44	26,398.94	33,417.42	15,336.09	\$3,637.18	\$7,173.09	\$4,674.72
Canal Record <sup>3</sup> .....	18,482.94	5,226.29	6,502.72	3,027.42	1,226.10	1,468.57	1,031.84
Young Men's Christian Association clubhouses—							
Operation <sup>4</sup> .....	51,516.74	14,571.99	18,151.74	8,449.11	3,418.08	4,063.74	2,832.08
Furnishing new buildings <sup>5</sup> .....	9,294.56	2,948.59	3,292.45	1,614.02	626.50	729.00	384.00
Isthmian Canal Commission band <sup>6</sup> .....	12,195.70	3,557.47	4,465.02	2,058.16	496.88	950.81	677.36
In the United States <sup>7</sup> .....	89,032.43	27,038.73	34,220.23	16,106.03	3,806.16	7,258.28	
Disbursing officers:							
In Washington <sup>8</sup> .....	33,496.49	10,312.85	13,036.33	5,974.75	1,413.42	2,759.14	
On Isthmus <sup>9</sup> .....	75,138.67	23,111.06	29,240.64	13,377.31	3,169.48	6,240.18	
Examiner of accounts:							
In Washington <sup>2</sup> .....	11,961.82	3,687.30	4,647.27	2,138.11	505.34	983.80	
On Isthmus <sup>3</sup> .....	174,150.68	53,677.48	67,690.12	31,024.06	7,343.76	14,415.26	
Transportation on Isthmus (passenger) <sup>4</sup> .....	124,547.33	37,323.03	46,495.66	21,522.93	8,733.15	10,472.56	
Telegraph and telephones <sup>5</sup> .....	141,152.48	26,552.58	77,218.07	11,721.83	11,699.61	13,990.39	
Purchasing expense in the United States <sup>6</sup> .....	194,242.55	83,964.11	41,861.21	60,587.08	1,009.45	4,856.47	1,964.23
Hotels, messes, and kitchens (operations) <sup>7</sup> .....	62,442.02	4,737.00	6,938.22	6,399.76	616.48	1,197.56	
Hotel equipment <sup>8</sup> .....	21,908.16	6,562.11	8,191.24	3,775.24	1,535.60	1,843.97	
Hotels, incidental expenses <sup>9</sup> .....	22,237.06	6,664.87	8,287.89	3,870.87	1,566.32	1,867.11	
Tivoli Hotel <sup>10</sup> .....	103.59	31.26	39.80	16.96	7.19	8.38	
Operation of stores <sup>11</sup> .....	485,516.80	200,117.95	144,916.43	123,362.28	3,086.89	10,618.08	3,405.17
Freight, advertising, and miscellaneous items <sup>12</sup> .....	4,157.55	1,378.64	742.54	1,885.86	10.39	140.12	
Recruiting <sup>13</sup> .....	75,313.43	24,026.86	28,135.77	13,728.33	3,439.48	5,982.99	
Quarters <sup>14</sup> .....	489,789.86	150,282.41	191,244.72	86,871.67	20,601.53	40,786.53	
Corrals:							
Equipment <sup>15</sup> .....	6,249.21	66.13	6105.09	40.75	610.19	624.05	
Operation <sup>16</sup> .....	4,923.93	1,365.90	2,076.42	805.06	201.39	475.16	
Construction of buildings, department of construction and engineering <sup>17</sup> .....	7,420.94	3,000.05	2,284.01	1,576.77	141.02	419.09	
Alteration and repair of buildings, department of construction and engineering <sup>18</sup> .....	7,327.54	2,727.28	2,395.82	1,563.82	189.24	421.38	

<sup>1</sup> Prorated on basis of total expenses of the three construction divisions, excepting amounts which can be definitely located to the work.<sup>2</sup> Prorated on basis of total salaries and wages charged to expenditures and to rock and sand manufacturing accounts, excepting proportion of general expenses on the Isthmus and of the Isthmian Canal Commission band, charged to relocation.<sup>3</sup> Prorated on basis of pay rolls for gold employees, excepting proportion of general expenses of the Canal Record and Young Men's Christian Association clubhouses, charged to relocation.<sup>4</sup> Prorated on basis of benefits received.<sup>5</sup> Prorated on basis of total value of material and supplies issued by quartermaster's department, less coal.<sup>6</sup> Indicates credit.<sup>7</sup> Prorated on basis of foreman's orders drawn.<sup>8</sup> Prorated on basis of total expenditures.

*Statement of general administrative expenses and of general expenses for twelve months, June, 1910, to May 1911, inclusive—Continued.*

	Total.	Atlantic division.	Central division.	Pacific division.	Civil administration.	Sanitation.	Relocation of Panama R. R.
Operation of docks and wharves:							
By the Panama R. R. Co. 1.....	\$52,188.98	\$32,517.26	\$20,583.22	\$25,951.01	\$479.61	\$2,453.90	\$173.90
By the Isthmian Canal Commission 1.....	21,965.87	8,545.12	5,990.21	6,552.21	124.51	713.89	230.85
Total.....	2,542,265.87	885,271.33	861,211.35	561,217.15	78,288.61	140,903.28	15,374.15

DIRECT DIVISION COSTS.

Transportation on Isthmus (freight) 1.....	\$503,000.00	\$84,774.82	\$208,947.92	\$194,877.26	.....	\$4,400.00	.....
Compensation to injured employees 2.....	186,779.56	84,826.74	66,764.86	32,946.13	\$2,115.87	125.93	.....
Total.....	689,779.56	189,601.56	265,712.81	227,823.39	2,115.87	4,525.93	.....

1 Prorated on basis of total value of material and supplies issued by quartermaster's department, less coal, and cement delivered to barges for Atlantic division.

2 Prorated on basis of actual freight handled.

3 Prorated on actual basis.

Note.—The month of June, 1910, is included in this statement and the month of June, 1911, is omitted, as the divisions and departments absorb the overhead expenses for each month in the accounts for the following month, with the exception of the overhead expenses charged to relocation, which are absorbed in the current month. Charges shown in last column above are from July, 1910, to June, 1911, inclusive. All of the above figures were absorbed in the fiscal year 1911 accounts.

The average cost of dry excavation in the central division and of wet excavation in the Atlantic and Pacific divisions to June 30, 1911, has been as follows:

Division.	Item of work.	Cost per cubic yard.			
		Work.	Plant.	General expenses.	Total.
Central division.....	Dry excavation.....	\$0.6579	\$0.1228	\$0.0655	\$0.8662
Atlantic division.....	Wet excavation.....	.1527	.0607	.0222	.2356
Pacific division.....	do.....	.1377	.0889	.0199	.2465

The average cost of concrete laid in the Atlantic and Pacific divisions to June 30, 1911, has been as follows:

Division.	Cost per cubic yard.			
	Work.	Plant.	General expenses.	Total.
Atlantic division.....	\$6.3134	\$0.6561	\$0.3061	\$7.2756
Pacific division.....	4.3862	.5676	.3335	5.2873

The work is being carried on well within the estimate of December, 1908, on which the bond issue of \$375,000,000 was based.

Every effort is being made to reduce the unit costs of work still further.

During the year Maj. T. C. Dickson, Ordnance Department, United States Army, has performed the duties of inspector of shops.

Mr. A. B. Nichols has remained office engineer in charge of the drafting room, drawings, and old French records in the chief engineer's office.

Mr. James G. Craig has filled the position of senior traveling engineer and Mr. A. C. Stone that of junior traveling engineer for locomotive work.

Mr. Don E. Irwin was appointed traveling engineer for the inspection of fuel and oil consumption, and the instruction of employees in respect thereto, on all equipment of the Isthmian Canal Commission and Panama Railroad Co., except marine equipment and locomotives, on July 11, 1910; on January 1, 1911, his duties were extended to cover marine equipment of the commission and Panama Railroad Co. except vessels of the latter plying between Cristobal and New York; and on April 1, 1911, upon taking over the work previously performed by the Lidgerwood inspector of the central division, he was appointed traveling engineer and inspector.

All officers and employees have performed their work in an efficient manner during the year.

Very respectfully,

H. H. ROUSSEAU,  
*Civil Engineer, United States Navy,  
 Member Isthmian Canal Commission,  
 Assistant to the Chief Engineer.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer,  
 Isthmian Canal Commission, Culebra, Canal Zone.*

## APPENDIX TO APPENDIX F.

**REPORT OF MAJ. T. C. DICKSON, ORDNANCE DEPARTMENT,  
UNITED STATES ARMY, INSPECTOR OF SHOPS, DEPARTMENT  
OF CONSTRUCTION AND ENGINEERING.**

ISTHMIAN CANAL COMMISSION,  
OFFICE OF THE CHIEF ENGINEER, SECOND DIVISION,  
*Culebra, Canal Zone, August 1, 1911.*

SIR: I have the honor to submit the following report on the work under my jurisdiction during the fiscal year ended June 30, 1911.

The duties of the inspector of shops are defined in Circular No. 339-A, a copy of which follows:

CULEBRA, CANAL ZONE, *December 13, 1910.*

1. Effective this date, the duties of Maj. T. C. Dickson, inspector of shops, are as follows:

2. He will report directly to the assistant to the chief engineer.

3. His jurisdiction covers all shops of both the Isthmian Canal Commission and the Panama Railroad Co.

4. As such, he will exercise general supervision over and inspect the economical distribution of work, employees, and tools among the various shops; the erection of new and alterations of existing shops; the procurement and installation of new tools and appliances in shops; the adoption of standard shop methods and the use of economical processes in the prosecution of mechanical work; the observance of rules and circulars in shops; the amount of superintendence in each shop and the competency thereof; and such other duties as may be assigned to him from time to time.

5. He will advise with division and resident engineers in charge of shops and the general superintendent of the Panama Railroad Co. and will give instructions to the superintendent of the mechanical division in regard to the duties with which he is charged.

6. He will give information to superintendents, master mechanics, and foremen in direct charge of shops in regard to approved shop methods, the use of economical processes, the observance of rules and circulars, proper shop discipline, methods of keeping cost of work, relative competency and amount of supervisory and clerical force, and on matters relating to shop management.

7. He will be furnished with all information and data he may require, which will be obtained in the most direct manner and from original sources of information.

8. In addition to the above duties his services in an advisory capacity in connection with all mechanical matters are available for use by the division engineers and other officials whenever desired.

The shops and mechanical apparatus in use on construction work have been inspected and the results thereof, with recommendations, reported monthly on Form 276—C. E. Shops having night shifts and hostling establishments have been inspected at night. The frequency of inspection of each shop is governed by the amount and character of work performed therein, and by special cases relating thereto. As many as 14 inspections were made of one shop in a month.

All complaints received from employees of unsatisfactory work, of slow delivery of work, and of apparent high cost thereof have been investigated and reported upon; the information derived from these investigations has been utilized to suggest methods intended to prevent future recurrences thereof.

The methods of performing operations on work, particularly in machines, and the speed, feed, and depth of cut used were observed, and in those cases in which the facilities of the shops permitted

more economical methods than were being used the matter was brought to the attention of the official in charge of the shop.

The transfer of machines from shop to shop was recommended in accordance with the needs of the work.

The principal data of each machine are being tabulated on a card form as a permanent record of reference and for use in selecting those to be installed in the permanent shops.

Among the miscellaneous duties performed were the making of investigations of special cases, advising relative to the purchase and use of material, service on committees, and transfer of construction equipment between divisions in particular cases.

The standardization of metal-cutting tools and the establishing of a central tool-dressing plant are awaiting the filling of a requisition by the Washington office for an expert tool dresser.

The following table shows for each shop the number of supervisors and their pay per month and the number of gold and silver employees and the total number of employees on May 21, 1910, October 31, 1910, and June 30, 1911.



*Number and pay per month of supervisors and number of gold and silver employees and total number of employees in each shop on May 21, 1910, October 31, 1910, and June 30, 1911.*

Shop.	May 21, 1910.				Oct. 31, 1910.				June 30, 1911.			
	Supervisory force.		Number of employees in shop.		Supervisory force.		Number of employees in shop.		Supervisory force.		Number of employees in shop.	
	Num-ber.	Pay per month.	Gold.	Silver.	Num-ber.	Pay per month.	Gold.	Silver.	Num-ber.	Pay per month.	Gold.	Silver.
	Total.				Total.				Total.			Total.
Dry dock.....	14	\$2,464.32	287	578	865	\$2,039.32	192	415	607	\$2,070.00	134	362
Gatun.....	9	1,600.00	60	200	280	1,360.00	50	152	202	830.00	48	132
Porto Bello.....	4	775.00	52	191	243	800.00	33	64	97	585.00	36	61
Spillway and dam.....	2	325.00	3	39	42	375.00	3	32	35	375.00	3	59
Toro Point.....	1	2,500.00	160	209	369	2,000.00	5	27	32	200.00	10	34
Empire.....	13	2,078.70	102	206	398	2,500.00	201	307	508	2,220.60	153	277
Balboa.....	3	600.00	21	96	117	1,695.60	73	248	321	1,538.90	73	222
Coccolí.....	25	4,937.50	417	604	1,021	5,187.00	741	1,043	1,784	6,735.30	530	1,247
Pedro Miguel.....	4	725.00	59	137	190	925.00	74	177	251	1,405.00	76	169
Las Cascaidas.....	3	575.00	20	36	58	575.00	23	43	66	710.00	23	42
Gambos.....	1	200.00	10	28	38	200.00	4	17	21	200.00	8	22
Tabarrilla.....	1	175.00	12	20	41	175.00	11	21	32	.....	.....	.....
Lirio.....	1	175.00	3	41	44	175.00	3	55	58	.....	.....	.....
Panama R. R. at Cristóbal.....	15	3,145.00	110	442	552	1,595.00	82	294	376	970.00	37	240
Panama R. R. at Panama.....	1	225.00	2	42	44	1,225.00	2	35	37	112.50	1	17
Total.....	108	20,500.52	1,318	2,964	4,282	18,026.92	1,497	2,930	4,427	17,933.30	1,432	2,873
												4,305

<sup>1</sup> Closed Sept. 15, 1910.

<sup>2</sup> Gorgona shops only.

<sup>3</sup> Closed in November and December, 1910.

<sup>4</sup> Closed Apr. 30, 1911.

The foregoing table shows there were 114 more gold and 91 less silver employees in all shops on June 30, 1911, than on May 21, 1910. All leading men acting in a supervisory capacity were not included in the list of supervisors dated May 21, 1910, but were included in the list dated June 30, 1911. The difference between the total monthly pay of supervisors on the two dates does not, therefore, show the saving made during the year in supervision in shops.

The following table shows the amount (subject to changes by adjustments) of the pay roll of each shop and the total pay roll of all shops for each month of the fiscal year. The average of the total pay roll of all shops for the last three months of the fiscal year was \$38,655.12 less than the average during the first three months thereof. This reduction appears to be a permanent one.

The second table following shows the total cost of overtime work in each shop and the total thereof in all shops during the last six months of the fiscal year. The amount of overtime, particularly on manufacturing work, has appreciably decreased during the year. The cost of overtime work was 3.75 per cent of the total pay roll of all shops during the last half of the year.

*Total overtime of each shop and total overtime of all shops per month during the last six months of the fiscal year ended June 30, 1911.*

Shop or division.	1911					
	January.	February.	March.	April.	May.	June.
Dry dock.....	\$1,819.72	\$1,574.18	\$2,257.02	\$2,000.47	\$1,633.04	\$1,044.34
Gatun.....	360.31	315.81	433.66	94.21		
Porto Bello.....	1,236.81	1,394.16	1,026.66	438.89	586.77	417.16
Spillway and dam.....	147.99	140.29	248.47	150.66	76.46	10.21
Toro Point.....	131.39	124.76	92.90	46.01	213.64	41.49
Empire.....	330.17	268.36	150.13	273.14	235.09	205.28
Balboa.....	1,357.60	1,289.02	1,896.74	2,513.61	972.60	1,945.69
Mechanical division.....	7,844.90	5,120.39	7,819.69	7,589.06	5,239.99	4,722.13
Panama R. R.....			326.73			
Total.....	13,228.89	10,216.97	14,252.00	13,196.05	8,957.59	8,386.30
Percentage overtime to total pay roll.....	4.10	3.29	4.33	4.61	3.03	3.06

<sup>1</sup> Transferred to mechanical division Apr. 5, 1911.

*Total pay roll of each shop and total pay roll of all shops per month during the fiscal year ended June 30, 1911.*

Shop or division.	1910					
	July.	August.	September.	October.	November.	December.
Dry dock.....	\$58,430.61	\$55,406.72	\$47,069.55	\$43,389.27	\$36,678.81	\$35,597.65
Gatun.....	16,197.15	16,609.02	11,884.33	12,507.60	13,764.69	13,755.88
Porto Bello.....	9,506.41	9,695.27	8,634.20	8,634.20	10,046.41	10,998.34
Spillway and dam.....	2,190.55	2,254.45	1,802.47	2,738.19	1,890.63	1,865.67
Toro Point.....					1,247.59	1,321.27
Empire.....	34,891.72	34,435.85	34,485.33	36,944.35	35,259.28	33,594.28
Balboa.....	34,013.27	36,879.66	32,012.43	31,916.76	33,246.09	24,443.85
Coccol.....	8,299.64	7,118.53				
Mechanical division.....	122,815.60	131,289.83	147,439.97	163,972.64	168,433.11	173,373.43
Panama R. R.....	35,233.70	38,978.90	29,607.15	28,596.65	21,908.15	20,705.50
Lirio planing mill.....	1,850.62	2,163.62	2,387.70	2,213.97	1,968.84	1,735.12
Total.....	323,399.27	334,630.85	315,343.13	330,924.23	324,413.60	317,390.99

<sup>1</sup> Closed September, 1910.

*Total pay roll of each shop and total pay roll of all shops per month during the fiscal year ended June 30, 1911—Continued.*

Shop or division.	1911					
	January.	February.	March.	April.	May.	June.
Dry dock .....	\$31,079.79	\$34,355.05	\$38,438.17	\$34,614.22	\$35,988.21	\$33,490.00
Gatun <sup>1</sup> .....	11,872.65	11,544.05	12,346.10	1,338.91		
Porto Bello .....	11,101.06	9,218.42	9,361.70	8,493.24	8,977.83	7,308.98
Spillway and dam .....	2,320.77	2,397.05	2,970.77	2,730.67	2,534.86	2,351.79
Toro Point .....	1,558.98	2,373.62	2,954.44	3,204.64	3,190.49	2,790.46
Empire .....	35,180.96	32,733.17	34,073.48	28,758.89	29,009.17	26,930.80
Balboa .....	17,786.02	22,688.00	24,535.33	24,239.82	23,411.28	16,685.84
Cocoli .....						
Mechanical division .....	187,506.47	171,686.52	183,180.89	168,091.84	176,469.66	171,599.84
Panama R. R. .....	22,472.70	21,524.26	20,058.41	13,678.98	16,257.71	14,204.65
Lirio planing mill <sup>2</sup> .....	1,534.62	1,506.88	1,539.84	1,254.20		
Total .....	322,414.02	310,117.02	329,459.13	286,405.41	295,839.21	275,363.26

<sup>1</sup> Transferred to mechanical division Apr. 5, 1911.

<sup>2</sup> Closed Apr. 30, 1911.

*Cost of hostling.*—The effort to reduce the cost of hostling has been continued; the results for standard-gauge equipment hosted by the mechanical division only are shown by the following table:

Month.	Total locomotives and other equipment hosted.	Average cost of labor per hostling.
1910.		
July .....	5,924	\$0.957
August .....	5,932	1.045
September .....	6,597	1.082
October .....	6,847	1.036
November .....	6,452	1.06
December .....	6,489	1.028
1911.		
January .....	6,809	.945
February .....	6,283	1.013
March .....	7,236	.8911
April .....	7,874	.879
May .....	8,487	.838
June .....	8,143	.972

The lowest average cost of labor per hostling made during the year by any hostling establishment was 69 cents and was made at Las Cascadas during the month of May.

*New shop.*—The only new shop erected and put in operation during the year was a small one at Toro Point for repairing locomotives, cars, and other equipment used in the construction of the breakwater; this shop was equipped with machines taken from other shops.

A sand tower and oil house were built for use in connection with hostling locomotives on the East Balboa dump.

*Shops closed and transferred.*—The completion of construction work in the Chagres district of the central division permitted the machine shop at Tabernilla to be closed in November and the hostling shed in December, 1910.

Work in the Cocoli shop (except that for the Ancon quarry) was transferred to the mechanical division on September 1 and the shop closed on September 15, with the approval of Mr. S. B. Williamson,

division engineer of the Pacific division. This change resulted in a saving in the cost of the work previously done in the Cocoli shop.

The Lirio planing mill was closed and the number of employees in the planing mill at Empire was reduced when manufacture of wood-work was consolidated at Gorgona.

The keeping of a permanent gang of craftsmen and helpers for making repairs to cableways and to concrete mixers at the Gatun Locks in the Atlantic division and on repairs to steam shovels during the day in the central division was uneconomical; these gangs were transferred to shops, and craftsmen and helpers sent from the nearest shop when required. This change resulted in the dismantling of the small repair shop at Las Cascadas.

The consolidation of heavy repairs at Gorgona and the transfer of repairs to vessels and to other apparatus in the vicinity of Colon and Cristobal to the dry-dock shop enabled the blacksmith, machine, boiler, and erecting shops of the Panama Railroad shops in Cristobal to be closed. Arrangements have been completed that will permit the paint shop, planing mill, and main steam power plant to be closed. A limited number of machines from the machine shop were installed in the roundhouse at Cristobal to enable light running repairs to locomotives to be made therein. The machine shop in the railroad yard at Panama was closed, as its operation was found to be unnecessary.

The shop at Gatun was turned over to the mechanical division on April 5 by circular No. 183-Q for a trial management of four months to ascertain whether or not a permanent transfer would prove economical and result in more efficient service, which has been the case to date.

*Additions to shops.*—The shed at Pedro Miguel used for repairing cars was doubled in size to save the time previously lost by workmen during rains. At the Gorgona shops an addition to the erecting shop was built for the pipe, tin, and copper shop and the equipment therefor moved from the boiler shop to provide additional space needed in the latter; a small building for the oxy-acetylene plant was erected; and the foundry building was extended and provided with a 25-ton overhead crane to afford necessary space and facilities for making large iron castings. The steel-casting plant under order will be installed in this extension. A lean-to along the paint shop has been authorized to shelter an acid and buffing plant for cleaning car lamps and other brass articles heretofore cleaned by hand.

*Consolidation of manufacturing and heavy repair work.*—It was found that some shops, particularly small ones, endeavored to perform all mechanical work sent to them regardless of the adequacy of facilities therefor. This was uneconomical and also resulted in requests for additional machines, tools, and larger plants. The same and similar classes of work were being done in different shops. The plant at Gorgona was the largest and best equipped for general manufacturing work and for making heavy repairs to all classes of rolling stock and other construction equipment, except steam shovels and marine equipment; the shops at Empire were engaged on and were adequately equipped for repairs to steam shovels. The policy of concentrating in the Gorgona and Empire shops all manufacturing work and heavy repairs to all except marine equipment was adopted

and prescribed in circular No. 343, which went into effect September 1, 1910. Further consolidations were made by circulars Nos. 343-A and 343-B.

When the above-mentioned concentrations of work were ordered, efforts were made to reduce the force in each shop to that required by the average amount of repairs previously performed by the shop. When repair work increased above the average, and to meet cases of emergency, provision was made for the obtaining temporarily of the necessary additional craftsmen from the mechanical division by circular No. 357. When the amount of repair work in a shop was less than the average, either other work was provided or the force reduced temporarily or permanently, as the case warranted. This system appears to have worked satisfactorily, and has proved its economy; its application will increase in the future.

*Reduction in foremen.*—These concentrations of work, reorganization of shops, and reductions in amount of work have resulted in the abolishing of the following supervisory force during the year:

Shop.	Position.	Monthly pay of position.
Porto Bello.....	General foreman.....	\$200
	Shop foreman.....	150
Dry dock.....	Assistant master mechanic.....	225
	Shipfitter foreman.....	175
	Erecting foreman.....	175
	Blacksmith foreman.....	175
	Outside foreman, yards.....	165
Gatun.....	Shop foreman.....	200
	General outside foreman.....	200
	Carpenter foreman.....	125
Cocoli.....	Master mechanic.....	225
	Machinist foreman.....	200
	Shop foreman.....	175
Balboa.....	Foreman carpenter.....	150
	Master mechanic.....	250
	Foreman machinist, floating shop.....	175
Panama R. R.....	Master mechanic.....	350
	General foreman, locomotive department.....	225
	Machinist foreman.....	200
	Blacksmith foreman.....	200
	Erecting foreman.....	200
	Boilermaker foreman.....	200
	Shop foreman, car department.....	200
	Painter foreman.....	200

In the Gatun shop a master mechanic at \$250 was replaced by a general foreman at \$225 per month. In the Empire shop, foremen of the machine and blacksmith shops at \$200 per month each and the foreman of the planing mill at \$175 per month were replaced by leading men. In the Panama Railroad shops at Cristobal the planing mill foreman at \$200 per month was replaced by a leading man and the night foreman in the engine house at \$200 was replaced with a hostler at \$140 per month. The general foreman of the engine house in Panama was assigned in addition thereto the duties of yardmaster, which effected a saving of \$225 per month. When the Cocoli shop was closed the foreman of car repairs at \$150 per month was replaced by a car repairer at 56 cents per hour. Corresponding reductions in the clerical force were also made.

As no increase was made in the supervisory forces of the Gorgona and Empire shops as a result of the consolidation of work therein, a

reduction has been effected during the year in the cost of shop superintendence and clerical force of over \$6,000 per month.

*Mechanics, special.*—A lack of uniformity was found to exist in the method of distributing the pay of mechanics, special—colloquially called “leading men”—acting in a supervisory capacity. Beginning with the month of June, 1911, the charging to supervision of the pay of leading men when engaged in a supervisory capacity was enjoined. The policy was also adopted, effective July 1, of putting leading men engaged principally in a supervisory capacity on a monthly instead of an hourly basis, with the title of assistant foreman.

*New machines and apparatus.*—Only those machines were purchased during the year that will pay for themselves and show a profit before the completion of construction work, or that will be required in the permanent shops, and the use of which during the remainder of construction work would result in economy. Among the machines purchased were two sewing machines for sail and awning work that was previously done by hand; one 6-inch power turret lathe for making bushings which were previously made in lathes in different shops; 2 heavy milling machines for gear cutting and general work, much of which was previously done on lathes, planers, etc., and therefore in a less economical manner; 1 automatic tool grinder for grinding shop tools and for use in central tool-dressing plant; oxy-acetylene plant, with supply of portable tanks for use in different shops; 1 washer cutter, for making washers out of scrap metal; one 25-ton overhead crane for use in the foundry at Gorgona until required in the permanent shop; a Taylor-Barth belt outfit. All of the above machines, except the sewing machines, were installed in the Gorgona shops.

The oxy-acetylene process has been most useful and economical, particularly in repair work. The cost of the entire plant was saved during one overhauling of the dredge *Caribbean*.

Requisition for a steel-casting plant, consisting principally of a 2-ton converter, blower, and sand grinder, has been approved. This plant will enable the stock of steel castings kept on hand to be reduced and the practice to be stopped of making parts urgently required of cast iron and brass that should be made of cast steel because of the availability of foundries for the latter.

*Shop rules.*—As experience indicated several desirable changes in the rules governing employees in shops, including an amelioration of punishment for certain offenses, they were revised and issued as circular No. 262-D, in both pamphlet and placard form.

*Shop expense.*—Thirty per cent had been prescribed as the shop-expense percentage to be applied to the distributed labor cost of articles manufactured in all shops; as the actual shop-expense percentage varied from month to month in each shop, differed widely in different shops, and was rarely 30 per cent, either repair work bore more than its share of overhead expense or the difference between 30 and the actual percentage for the month was applied to the distributed labor on manufactures. The practice was adopted of fixing the shop-expense percentage for each shop from its previous amounts, the difference between the actual amount and that prescribed for each month for each shop being carried as a debit or credit by the examiner of accounts. The percentage for each shop is changed

from time to time so as to keep the balance as small as practicable. The shop-expense percentages prescribed so far have been as follows:

Division or shop.	Shop-expense per cent.	
	Jan. 1, 1911.	May 1, 1911.
Mechanical division.....	33	37.5
Empire shop.....	63	40
Dry-dock shop.....	50	45
Balboa shop.....	50	30
Gatun shop.....	45	
Porto Bello shop.....	30	25
Panama R. R. shop.....	45	

Advantage was taken of this change, which was prescribed in circular No. 264-A, to more clearly define distributed and undistributed labor and material and to require the reporting on Form 222-C. E. the cost of all overtime performed during each month.

*Date of delivery on work requests.*—Most repair and manufacturing work is required by construction officials as soon as obtainable or by a given date. Circular No. 197-G was issued requiring the date of delivery to be placed on each work request for the guidance of the shop. Urgent deliveries are indicated by the word "Rush," which means 16 hours' work thereon without overtime per day until completed (Sundays and holidays excepted). Cases of emergency are indicated by placing on the work request the number of hours overtime authorized per day, which is in addition to the 16 regular working hours. This information, supplemented by a system of management in Gorgona shops hereinafter described, has materially assisted in completing work by the dates specified.

*Resignation of boiler makers.*—A large number of boiler makers submitted their resignations with due notice the last part of November, 1910, and their places were filled during the following two months by recruiting in the United States. A limited number of manufacturing orders involving boiler makers' work were canceled and the articles ordered from the United States. Construction work was neither delayed nor interfered with by this action of the boiler makers.

*Reductions in the force of craftsmen.*—To prevent the discharge of craftsmen on account of lack of work in one shop and the making of requisitions for craftsmen of the same trade by other shops, circular No. 262-E was issued requiring surplus craftsmen to be reported to the inspector of shops with the view to their transfer where needed. This practice has reduced the number of requisitions made on the Washington office for craftsmen, has enabled the services of good men familiar with the conditions and work on the Isthmus to be kept continuously and efficiently in service, and has proved economical.

Difficulty in obtaining craftsmen with general and varied experience has resulted in the requiring of shop managers to try new employees on different classes of work until their incompetency on all available classes of work of their trade is demonstrated or a class of work found that an employee can competently perform. Transfers between shops have been made to attain this object.

*Gorgona shops.*—To enable repair and manufacturing work to be prosecuted 16 hours per day without overtime, night shifts were put

in the machine, erecting, blacksmith, and boiler shops in August and September last. While work of the class involved is usually more expensive when performed at night than during daylight, the night shifts have proved efficient and have saved much expense for overtime. In addition to materially reducing the length of time required in completing urgent orders. A night shift was put in the wood car repair shop on February 1, 1911, which has enabled Lidgerwood flat cars cut out for light and medium repairs one day to be returned to service the next morning. Small night shifts in the carpenter shop and planing mill have proved economical.

The time of each employee was distributed to the proper accounts either from a slip made out daily by him or from records kept by timekeepers, showing the number of hours spent by him on each job. Neither of these systems gave accurate results and both were uneconomical. The trial of a new slip by gold employees was started on May 1 in the machine shop, the foreman entering on the slip the shop-work order number, the serial number of the employee, the number of pieces, and the operation to be performed. When a job is assigned, the date, hour, and minute are stamped with a time-clock stamp on the slip, which is retained by the workman until the job has been completed, when the date, hour, and minute are stamped on the slip. All slips are required to be turned in on the last day of each month. This distribution slip has the advantages of decreasing the clerical work involved in distributing the cost of labor on each job, gives an accurate record of the total length of time spent by each employee on each job, and brings the latter time to the direct attention of the foreman when all circumstances connected with the performance of the work are available. In the cost-keeping office a compartment or envelope can be assigned to each shop-work order and all distribution slips and foremen's requisitions for material pertaining to it segregated therein; the cost of labor and material can be totaled from time to time during the month and entered on consolidation cards. This system was started in the blacksmith shop and locomotive department on July 1 and should be extended to other departments and to silver employees as soon as time clocks requisitioned for shall have been received.

The large number of shopwork orders, the need of completing each order by the date specified, and the great variety of work handled by the locomotive department rendered necessary the adoption of a system by which all foremen therein could have in accessible form the dates on which work on each job should be started and completed to insure delivery by the required date. This system was started during the month of June and has already had a beneficial effect upon the management of the locomotive department. To Mr. A. L. Robinson, superintendent of the mechanical division, belongs the credit for working out the details of and installing this system.

The preparation of shopwork orders for all manufactures in the drafting room was started on October 1, 1910. A detailed bill of material is prepared for each manufacturing order on a special blank which is sent to the storehouse, and the amount of material required is there reserved for use under that order if in stock. If not in stock its procurement is undertaken and the expected date of its receipt is indicated on the bill. The bill of material shows the amount of each item of material allowed, the quantity of each item in stock, the



expected date of receipt of each item not in stock, and the shop by which each item is to be drawn from the storehouse. Each shopwork order when issued to the shops is accompanied by a copy of the bill of material and by the necessary foremen's requisitions for the material ready for presentation to the storehouse. When material specified on drawings is not on hand and an early delivery of the completed article is required, material available and suitable for substitution is determined and submitted to the division engineer for approval of its use. This system has also proved of assistance to the storekeeper in the performance of his duties. It has not been applied to repair work, but its application thereto is under consideration. Foremen should not be allowed to draw from the storehouse material either in kind or quantity for any job other than that on the bill of material and for which proper foremen's requisitions are furnished. Should additional material be required on account of any having been spoiled during manufacture or for other reasons, the foreman should report his needs and reasons therefor. When sizes of stock material necessitate the drawing of a larger quantity than is actually required, including unavoidable waste, a return slip in triplicate should be issued showing the amount to be returned to stock by the foreman and the latter should be required to return the surplus, obtain a receipt therefor from the storekeeper, and deliver the receipt to the cost clerk. This system should prevent the drawing of unnecessary material, has relieved foremen from the clerical work connected with the preparation of bills of material, the making out of foremen's requisitions therefor, and with ascertaining the quantity in stock, and has given them more time in which to plan and supervise the details of the work under their charge. The effect on the efficiency of the plant is already apparent.

The new work order, the distribution slip, and the placing on each work order in the shops of the dates on which each foreman must start and must complete his work thereon, constitute all material changes in shop management had in view for the present shops.

To prevent the sending out of incorrect and incomplete work an inspector of finished material was appointed on December 20, 1910. As work is completed and shipped by two shifts of eight hours each and as the output was greater than one inspector could handle, an assistant inspector was authorized on May 15, 1911. This inspection does not apply to locomotives, cars, and similar equipment, for which separate inspection systems exist. The inspection of finished articles and the testing out of apparatus before shipment has noticeably reduced the number of complaints about unsatisfactory work and the annoyances and delays caused by it to construction officials. It has also improved the quality of work done in the shop.

At the beginning of the year a number of complaints were made that iron castings could not always be obtained on the required dates. The quantity of all iron castings on order and uncompleted and of each order as received was calculated and on September 1, 1910, the uncompleted orders amounted to 3,445,484 pounds. The output in September was 584,263 pounds. An enlargement of the iron foundry was authorized and the output increased until the uncompleted orders on June 30, 1911, amounted to 2,549,499 pounds, of which the major part were for the locks and spillways and not required until some time in the future.

With the view to bringing defective work to the attention of the foundry it was prescribed by Circular No. 215-B that defective castings be returned to it and the cost of any casting and of machine work lost thereon be charged to the foundry account. To decrease the loss in time while pouring and to permit different percentages and kinds of scrap to be used in iron castings, the molders were divided into three shifts, beginning work at 6, 7, and 8 a. m.

An investigation of complaints showed that the cores in a number of hollow cylinders of brass had amalgamated and that a few iron castings for pistons, piston rings, and other similar important parts were not of the required solidity and quality. Effort has been made to remedy these defects.

An electromagnet and steam-driven generator for supplying the necessary current were purchased and applied to a locomotive crane for handling steel and iron.

A sand blast for cleaning and a compressed-air spray for painting steel dump cars have been installed and have proved economical.

On May 24 the hour at which the night shift in the various shops commenced work was fixed at the quitting hour of the day shift; this enables the night shift to connect up with the day shift and has proved advantageous.

A committee of machinists complained about the length of time required on occasion to draw coupon books; this was investigated and remedied.

A more equitable method for determining the cost of repairs to and field inspection of cars belonging to the different divisions and departments without increase in cost of clerical labor was devised, recommended by a committee, and put into effect.

*Empire shop.*—This shop is under the jurisdiction of the division engineer of the central division. It is engaged principally on the manufacture of spare parts for and on repairs to steam shovels; heavy repairs to rock-drilling machines and to dippers, buckets, and sister links for dredges were assigned to this shop by the provisions of Circular No. 343.

Two oil furnaces were installed in the blacksmith shop, as they were more economical for certain classes of work than coal forges. The methods used in performing operations in the machine shop were criticized in a number of cases, which resulted in more economical methods being used.

Mr. W. H. Bates, superintendent of steam-shovel repairs, was given, under the inspector of shops, supervision over repairs to steam shovels in the Atlantic and Pacific divisions, in addition to those in the central division, and was charged with the preparation of lists of spare parts for steam shovels to be kept in the different storehouses, exclusive of the Empire storehouse, for use by the chief quartermaster. As a result of this action a material reduction was made in the supply of steam-shovel parts kept on hand at several places, particularly at Porto Bello. Mr Bates suggested that a limited number of the parts most frequently required in repairing steam shovels and applicable by the crew be kept on each shovel; this suggestion was adopted and has proved both satisfactory and economical.

*Dry dock shop.*—This shop is under the jurisdiction of the division engineer of the Atlantic division and is engaged principally in the

maintenance of the dredging and transportation fleets at the Atlantic end of the canal. Repairs to Panama Railroad and commercial vessels and mechanical work for individuals and companies in Colon and Cristobal were transferred from the Panama Railroad shops to this shop on March 1. At the beginning of the year this shop had more work than could be economically and satisfactorily handled with its facilities; this condition was remedied and the efficiency improved by the transfer of manufacturing work to Gorgona. An oil furnace was installed in the blacksmith shop, a condenser in the power house, a few machines transferred from other shops, and a sewing machine purchased. A 60-inch throat punch and shears were transferred to the Gorgona shops, where they could be more advantageously used.

The distribution slip described above under Gorgona shop was introduced into this shop in April for all employees except those in gangs and has proved its superiority over the previous system for distributing time.

*Balboa shop.*—This shop is under the jurisdiction of the division engineer of the Pacific division and is engaged principally in the maintenance of the dredging and transportation fleets at the Pacific end of the canal; it also makes repairs to commercial vessels. The amount of work and consequently the shop force were materially reduced during the year. The two carpenter shops were consolidated and the supervisory force reorganized and decreased.

*Gatun shop.*—This shop was under the jurisdiction of the division engineer of the Atlantic division until April 5, when it was transferred to the mechanical division for a four months' trial in its management. It is principally engaged in making light running repairs to locomotives, cars, cranes, spreaders, and to the miscellaneous equipment used in the construction of the Gatun locks; it is also an hostling establishment. The supervisory force in this shop was reduced and reorganized. Shortly before the transfer of this shop to the mechanical division it was found that boiler flues in some locomotives and air-brake equipment on some cars had not been kept by it in proper condition; these defects were remedied.

*Pedro Miguel shop.*—This shop is under the superintendent of the mechanical division. It is principally a car repair and hostling establishment; light repairs to all construction equipment used in the construction of the Pedro Miguel and Miraflores Locks were transferred to it when the Cocoli shop was closed.

More locomotives are hostled each night at it than at any other establishment; the average per day during June was 105.

The small storehouse installed at this shop by the chief quartermaster was of much assistance in its management.

A night shift of car repairers was put on in February which enabled nearly all Lidgerwood cars requiring light repairs received one day to be made ready for service the next morning.

A general foreman from this shop makes detailed inspections daily of steam shovels, locomotive cranes, concrete mixers, and other mechanical apparatus used in the construction of the Miraflores and Pedro Miguel locks—except berm and chamber cranes and narrow-gauge locomotives and cars—and superintends repairs thereto that are approved by the proper construction officials. As many repairs as practicable are made by the night shift while the apparatus is idle.

The operations of the remaining shops call for no special comment.

A mechanical committee consisting of the superintendent, master mechanic, and general foreman of the principal shops and hostling establishments and the inspector of shops was appointed in April, 1911, by circular No. 383 to meet monthly for the purpose of standardizing shop practices and methods, securing uniformity in performance of work, disseminating useful information, and discussing shop methods and mechanical work. Much benefit is expected to result from these monthly meetings.

A special form, C. E. 298, was prescribed in April, 1911, by circular No. 384 for reporting to the office of the chairman and chief engineer all work of an unsatisfactory character performed by one department or division for another. The number of justifiable complaints made so far in regard to mechanical work performed in shops has been gratifyingly small, particularly when the large number of jobs completed each day—work on many of which is prosecuted at high speed—is considered.

Variations from time to time in the quantity of mechanical work, both manufacturing and repair, render difficult the proportioning of the force to the amount of work in each shop. A few shop officials have shown a reluctance to assent to necessary reductions in the force of gold employees, even when they are effected by transfer to other shops.

A large percentage of repair and manufacturing jobs are required either as quickly as it is possible to do the work or within a very limited time; this condition and the large number of such jobs render the management of commission shops much more difficult than that of the average shop in the United States and increase the difficulty of performing the work economically. Superintendents, master mechanics, and foremen—except in isolated cases—have performed the exacting and complicated duties imposed upon them in a most creditable manner and have shown a personal interest in their work that is highly commendable.

The gold employees—with some exceptions—are good craftsmen, show an earnest interest in their work, and cheerfully respond to the exacting demands made upon them.

Considering the varied character of the work and the high speed at which much of it has to be performed, the general efficiency of the shops is considered creditable.

Respectfully submitted.

T. C. DICKSON,  
*Major, Ordnance Department, United States Army,*  
*Inspector of Shops.*

Civil Engineer H. H. ROUSSEAU, U. S. Navy,  
*Assistant to the Chief Engineer,*  
*Isthmian Canal Commission, Culebra, Canal Zone.*



## APPENDIX G.

### REPORT OF A. L. ROBINSON, SUPERINTENDENT MECHANICAL DIVISION, DEPARTMENT OF CONSTRUCTION AND ENGINEERING.

GORGONA, CANAL ZONE, *August 1, 1911.*

SIR: In accordance with your circular letter of June 16 I have the honor to submit herewith annual report covering the operations of the mechanical division for the fiscal year 1910-11.

During this year the mechanical division has operated under practically the same organization as that maintained during the year 1909-10.

The policy of concentrating all manufacturing work and repairs to rolling equipment other than steam shovels in one shop, which was inaugurated during the previous year, has been maintained and greatly enlarged upon.

The issuance of your circular No. 343, to take effect September 1, 1910, concentrated practically all manufacturing work in Gorgona shops. With the concentration of this manufacturing work the forces in other commission and in Panama Railroad shops were greatly reduced, the ultimate object being to maintain in all shops other than Gorgona only such forces as were necessary to handle the average amount of running repair work for which these shops were responsible. When any extraordinary quantity of running repair work came into outlying shops the officials of those shops were permitted to call upon Gorgona shops for the temporary transfer of sufficient mechanics of all trades to care for such extraordinary work.

With all manufacturing and stock work concentrated in one shop that shop is in a position to so regulate its forces as to keep plenty of work on hand for all of its employees, and it is at the same time in a position to lend employees to outside divisions, since such transfers only temporarily set back the completion of manufactured work which is to be placed in stock.

This concentration has also enabled the central shop to have a much larger number of employees handled by the same supervisory force, thus lessening the percentage of supervisory expense.

The emergency repairs required upon all classes of equipment used in construction work has always necessitated a large amount of time in excess of the regular eight-hour day, which overtime work was paid for at the rate of time and one-half. No one shop on the Isthmus handled enough of this emergency work to warrant maintaining a large night shift to take care of same. With the concentration of work in Gorgona shops there has been established a night force, consisting of practically every trade, so that this shop has since been in

a position to work 16 hours out of the 24 upon any emergency work sent in without paying overtime rates. The establishment of a night force in car shops alone has enabled us to practically maintain two additional trains of 20 cars each in the central division without the purchase of any additional equipment.

In addition to concentrating all manufacturing work in Gorgona shops, the policy was inaugurated of either closing up field repair shops or placing the operation of same under the jurisdiction of the mechanical division. In the Pacific division the shops at Cocoli were entirely abandoned, the work formerly done in these shops being handled at either Pedro Miguel engine house or at Gorgona. The field repair forces operating from this shop were placed under the jurisdiction of the general foreman of the Pedro Miguel engine house. The field shop at Gatun was transferred to the mechanical division, and the field forces, hostling locomotives and making repairs to cars, were placed under the mechanical division's general foreman at that point.

The transfer of these field shops and forces has resulted in a marked saving in supervisory and labor expense and, in addition, has given the mechanical division a much closer and more intimate knowledge of the condition of the field equipment, upon which they have always made the heavy repairs.

With field and shop repairs being made by one department, much better foresight can be employed in the keeping on hand of the necessary repair parts and in the making of repairs at such times as to obviate the necessity of putting the mechanical appliances out of commission during working hours.

Such policy also facilitates the reducing to a minimum of the number of repair parts to be kept on hand and expedites the transfer of such repair parts to the point most urgently needing same.

In addition to the economies mentioned above, resulting from this concentration policy, we also have the resultant economy which must always follow the working of any shop up to its maximum capacity.

While the increase in the number of men employed in the mechanical division has amounted to 50 per cent, with the consequent increase of the labor roll from \$122,815.60 to \$187,479.69, this increase of work has been handled with only 24,020 square feet additional floor space, and with only the addition of such few machines (mainly transferred from other shops) as are mentioned below under the operations of the different departments of this division.

The organization of the mechanical division on June 30, 1911, was made up as follows: Superintendent, A. L. Robinson; mechanical engineer, J. H. Flynn, jr.; superintendent of electric light and air compressor plants, Hartley Rowe; chief clerk, William Taylor; chief draftsman, C. E. Whipple; testing engineer, Q. A. Hall.

A summary of the operations of these different departments is given below.

#### GORGONA SHOP.

During the year only such additions have been made to these shops as were absolutely necessary to care for the increased work accruing from the concentration policy mentioned above.

## LOCOMOTIVE DEPARTMENT.

[General foreman in charge, Mr. A. T. Corcoran.]

## MACHINE SHOP.

The facilities of this shop have been increased by the installation of the following new machines, purchased in the United States, and which will be ultimately required in the permanent shops to be later erected at Balboa: Two No. 5 motor-driven universal milling machines; one automatic tool grinder, and one 28-inch Pond motor-driven turret lathe. Also, the capacity of this shop has been increased by the transfer from other shops of the following machines: One drill press; one cold saw; two tool grinders, and one shaper.

The machine shop power plant was increased by the addition of one 125-kilowatt 220-volt direct-connected engine-driven generator, transferred from Balboa power plant.

A repair outfit for the tightening and maintenance of all belts was installed. The Taylor system for placing proper tension on and recording repairs to all belts in use in Gorgona shops is now being followed.

A night force of from 30 to 40 machinists has been employed in this shop upon all classes of rush work.

No addition to the floor space in this shop has been made.

## BLACKSMITH SHOP.

The only additional machinery installed in this shop has been one 1,000-pound steam hammer and a bolt-heading machine, transferred from the Cristobal shop of the Panama Railroad Co. The usual number of dies, formers, etc., used in the manufacture of new work were made.

No additional floor space has been added to this shop.

## PIPE AND TIN SHOP.

The pipe and tin shop, formerly occupying space under the boiler shop roof, was transferred to a lean-to of 3,080 square feet floor space, built against the erecting shop. This new location of the pipe and tin shop was equipped with forges, rolls, and other tools removed from the former location, no new or transferred tools having been required by the increased work.

## BOILER SHOP.

Two thousand seven hundred square feet of floor space was added to this shop for the manufacture of side doors for steel dump cars. This additional space was secured by building a lean-to roof out of secondhand wood car material and French roofing; also 3,000 square feet of floor space was secured by the transfer of the pipe and tin shop mentioned above.

The only additional equipment purchased for this shop was a punch, for the manufacture of cut washers from scrap plate. In addition, one punch and shear was transferred to this shop from the Panama Railroad Co.'s shop at Cristobal.



The machinery in this shop was operated by a French engine of obsolete type, which was constantly giving trouble, and which was therefore replaced by a secondhand engine obtained from the Balboa power plant.

The usual number of templates, forms, patterns, etc., made necessary by the variety of work handled in this shop, were manufactured.

#### OXY-ACETYLENE PLANT.

A complete plant for the generation of oxygen and acetylene gas was installed, with all auxiliary apparatus necessary for the operation of cutting and welding torches with this oxy-acetylene process. This plant is of sufficient capacity to charge portable cylinders with oxygen and acetylene gas for use at shipyards, field and other repair shops; these portable outfits enabling welds to be made in the field, thus obviating the necessity of removing broken materials and shipping same in to Gorgona shops.

#### CAR AND FOUNDRY DEPARTMENT.

[General foreman in charge, Mr. J. J. Eason. Chief car inspector, Mr. Wm. G. Hull.]

#### CAR SHOPS.

No additional buildings or floor space was added to either of the car shops at Gorgona. During the past year, however, the Panama Railroad Co. has transferred to this point all of its passenger car work, other than light running repairs, and in addition a large part of the heavy repairs to Rodger ballast cars, box and stock cars, and steel flat cars. Night forces were established in the wood car shop for the performance of light repairs to Lidgerwood flat cars, this night work permitting the returning to service each morning of all light repair cars sent in the evening before. The number of repairs, both field and shop, made to the various classes of cars is given in detail on the attached data sheet marked "Exhibit C."

A sand blast installation was made for the cleaning of scale from steel cars. All steel cars undergoing heavy repairs are cleaned with this sand blast of all rust and scale; they are then moved and spray painted with coal-tar paint, the paint spray being operated by air, thus saving all brush and handwork on same.

#### PLANING MILL.

During the past year the Lirio planing mill, which was operated under the jurisdiction of the quartermaster's department, and the planing mill of the Empire shop, which was operated under the jurisdiction of the central division, have been closed up. The work formerly performed in these two shops, consisting of the manufacture of jack blocks, tamping sticks, hand and push cars, coffins, sash, doors and blinds, cabinets, and all classes of planed and finished material for building purposes, has been transferred to Gorgona shops. In addition the planing mill of the Panama Railroad Co.'s Cristobal shop, which was engaged in the manufacture of all classes of finished car material, has also been closed and that work transferred to Gorgona shops. With the addition of a night force in the Gorgona planing mill we have been enabled to handle all of this

increased work without any increased floor space, and with only the addition of the following machines, transferred from the Lirio planing mill: 3 wood saws, 1 blind borer and matcher, 1 blind wiring machine, 1 door and sash clamp machine, 1 saw gummer, 1 mortiser, 1 molding machine, 1 sandpapering machine, 1 sash sticker, 1 slot tenoner, 1 tenoner.

#### FOUNDRY AND PATTERN SHOP.

While the foundry work during the year 1909-10 was increased 65 per cent over that of 1908-9, the output during the heaviest month of 1910-11 shows an increase from 519,554 pounds in June, 1910, to 920,381 pounds in March, 1911, an increase of 77 per cent. This large increase was mainly due to the manufacture of caisson seats, culvert liners, and counterweights being made for lock construction.

As the Gorgona foundry has never been equipped for the manufacture of any castings other than brass and gray iron, it has been necessary for the commission to purchase in the United States all steel castings used in the repairs to equipment. During the past fiscal year estimates were made of the value of the steel castings carried in stock as repair parts, the annual purchases of same, and of the reductions which might be made in the stock of these parts if the Gorgona foundry were equipped for the manufacture of steel castings on short notice. This data, taken in conjunction with the service requirements of the permanent shops, made the purchase of a steel foundry equipment advisable. An addition to our present foundry of 9,000 square feet has therefore been constructed for the reception of this steel foundry equipment. This additional building was constructed throughout of secondhand material, old car sills, and second-hand French roofing having been utilized. This building has also been equipped with a 25-ton overhead traveling crane, which crane will be necessary for, and will be utilized in, the permanent shop. An abstract of the operations of both the brass and gray iron foundries is given in detail in Exhibit D, attached.

#### ENGINE HOUSES.

The engine houses and repair shops operated by this division at outside points are as follows:

Pedro Miguel engine house: General foreman in charge, Mr. J. J. Bartley.

Gatun engine house: General foreman in charge, Mr. T. H. Jordan.

Las Cascadas engine house: General foreman in charge, Mr. E. B. Connor.

Gamboa engine house: Foreman in charge, Mr. Robert Bailey.

With the closing of the Cocoli shops, the average number of engines hosted nightly at Pedro Miguel engine house was increased from 60 to 90, without any additional increase in either buildings, tracks, or coal chutes. This engine house also handles all field repairs required by all mechanical appliances in both Pedro Miguel and Miraflores lock sites, other than repairs to narrow-gauge locomotives. The car forces at Pedro Miguel were augmented by a night force to care for light running repairs to Lidgerwood flat cars, the same as was established at Gorgona. The car-repair shed at this point was increased by a lean-to of 8,340 square feet. The light and heavy

repairs formerly made to Pacific division cars at Cocoli shops are now made at Pedro Miguel for light repairs and Gorgona for heavy repairs.

The forces at Gatun engine house make all field repairs to mechanical appliances used in the construction of Gatun locks and dam, and, in addition, make all running repairs to locomotives and cars operating in that territory.

The number of pieces of equipment hosted at these outlying engine houses during the past year is as follows:

Total hostlings to locomotives.....	73, 667
Total hostlings to other equipment.....	9, 410
<hr/>	
Total labor cost.....	\$81, 209. 93
Total material cost.....	6, 658. 75
<hr/>	
Total.....	87, 868. 68

The average direct labor cost for the year for all hostlings was \$0.9775 per unit hosted.

#### MECHANICAL ENGINEER'S DEPARTMENT.

The mechanical engineer has under his supervision the work of the chief draftsman, testing engineer, boiler inspectors, material inspector, and requisition clerk, and in addition to outlining and directing their work, prepares all specifications covering special requisitions for material and equipment for this division, acts in a consulting capacity on committees with engineers of other divisions when called upon, and as chairman of the committee on standard specifications prepares and submits specifications covering all standard material purchased by the commission. During the past year 75 of these standard specifications have been revised and submitted.

#### CHIEF DRAFTSMAN.

The chief draftsman has supervision of the planning department and drafting work, both of which are concerned principally with the manufacturing and repair work of the division. The planning department has been introduced during the past year with the view of facilitating the handling of manufacturing and repair work and for the relieving of the foremen of the analysis and checking of drawings, as well as the locating and ordering of the material necessary in the performance of the work. While this planning department is considered an economical feature, its introduction was made necessary in Gorgona shops by the increased responsibilities placed upon foremen by the concentration of work at this point. When an order is received it is referred to the planning department for interpretation and analysis; if accompanied by drawings these are indexed, checked, and pattern numbers assigned. If samples or descriptions are furnished drawings are supplied if necessary. A bill of material is then prepared, which gives in complete detail the material required, and directs the course taken by the order through the shop; also, the material specified on this bill of material is reserved for each particular job. During this process any impracticable features, errors, or substitutions necessary are taken up with the division ordering the work, and are corrected. The text of the shopwork order or casting order is arranged and the whole is then forwarded to the shopwork

order department for issue. During the year there has been prepared 3,115 casting orders, 4,340 shop orders, and 2,200 bills of material.

In the drafting room there has been prepared 950 drawings and sketches, 912 foreign drawings have been indexed and filed, and 1,870 patterns have been assigned numbers and recorded. All estimates on manufacturing work are compiled by the chief draftsman, and standard prices have been fixed for over 2,000 items of repair parts. A complete record of machine tools on the Isthmus is being compiled showing all data relating to their purchase, installation, uses, and equipment.

In connection with the belting system which has just been installed, a record of each belt has been made and the tension calculated, on which record is entered the date and other data for all belts tightened or renewed.

A number of pattern lists, covering more than 7,000 patterns, have been compiled and distributed.

Such other miscellaneous work in connection with an organization of this nature has been satisfactorily performed.

#### TESTING ENGINEER.

The testing engineer has charge of the testing department. This department is equipped for conducting efficiency tests on boilers, engines, and other equipment, the calibration of various instruments, and certain economical tests on a variety of standard materials. While not especially equipped with apparatus for determining the strength of materials and other physical tests, a number of such have been accomplished with improvised apparatus. The larger portion of the work of the testing engineer has been performed for other departments, viz, the quartermaster's department, relative to the quality of supplies received, and the different divisions with reference to efficiency and economy of various equipment.

A branch office of this department is maintained at Balboa for making daily tests on the quality of crude petroleum as furnished by the Union Oil Co. As a result of these tests (by distillation) there has been allowed rebates amounting to \$8,751.91 on the purchase of this one item.

During the past year a total of 860 tests have been performed, covering a wide variety of subjects, among which were tests on boilers, engines, cranes, pumps, unloaders, and oil burners for economy and efficiency; oil, coke, charcoal, alcohol, paints, and greases for analysis and quality; steel, valves, paints, and gaskets for service; chain, crockery, and concrete slabs for ultimate strength. Two fuel-oil tanks were strapped, calculated, and a chart prepared showing capacities for each one-fourth inch in height. Charts were made up showing the amount of compressed air with the cost for each compressor plant in this division. Two locomotive tenders have been calibrated for coal capacity. In addition, there has been a number of observations and records relative to the economy and efficiency of shop equipment.

#### BOILER INSPECTION.

There are four boiler inspectors who make regular inspections and annual hydrostatic tests on all boilers in the service of the Isthmian

Canal Commission and the Panama Railroad Co. Records of these inspections and tests are filed, and the heads of divisions and departments are duly notified of the condition of the boilers under their jurisdiction. During the past year this department has formulated a new set of rules covering the inspection, operation, and equipment of boilers, these rules being compiled from and incorporating the most desirable features of a number of the standard rules, with such modifications as are necessary to meet the peculiar local requirements. These have been approved by the committee appointed by the chairman and chief engineer to consider the revision of the boiler inspection rules, and have been submitted to him. All boilers in service have been calculated for their safe working pressure, and plates showing the boiler number and its pressure have been attached to practically all of these boilers.

#### MATERIAL INSPECTOR.

The mechanical engineer has also under his jurisdiction the material inspection department. This department inspects all material received on requisitions made up by this division and has charge of the up-keep of stock for which this division is responsible. A card record is kept of all repair parts for rolling equipment, and from this record the requirements are anticipated and orders placed for the necessary material to protect them. Outside points are furnished with supplies and repair parts for regular and emergency work. A number of estimates covering standard stock for the use of this division have been prepared at the request of the quartermaster's department. A system has been instituted whereby all repair parts and auxiliary equipment on rolling stock which have become damaged, but considered worth repairing, are returned to the shops, repaired, and reissued through the quartermaster's department, which has resulted in a very considerable saving in up-keep.

#### ELECTRIC LIGHT AND AIR COMPRESSOR SUBDIVISION.

This division continued the operation and maintenance of the air compressor plants at Las Cascadas, Empire, Rio Grande, and Balboa; the operation and maintenance of the electric power and lighting plants at Cristobal, Gorgona, Empire, and Balboa; the construction and maintenance of distributing systems from the above-mentioned power plants; the wiring and maintenance of all lighting in all commission quarters, offices, storehouses, etc.; and the installation of motors and other electrical apparatus, including repairs to all blasting batteries and galvanometers.

The above-mentioned work included the maintenance of 46 miles of pole line, with 134 miles of overhead lines upon same; the maintenance of some 33,000 lamps; the rebuilding of 6½ miles of pole line, with 45 miles of wire upon same; the construction of 2 miles of new pole line, with 12 miles of wire upon same; the maintenance of 42 motors, with a total horsepower of approximately 1,200; and the installation of 16 new motors of 415 horsepower capacity.

The total number of shop orders handled by this division during the year amounted to 639.

During this year the output of the electrical plants of this division amounted to 4,911,134 kilowatt hours, which, with 1,910,767 kilowatt hours furnished by other divisions, gave a total electrical energy distributed by this division of 6,821,901 kilowatt hours.

This division operated, throughout the year, air compressors, the combined output of which is believed to be larger than any other air installation at present operated in the world.

Six Laidlaw-Dunn-Gordon compressors of 2,500 cubic feet capacity each, and 8 Ingersoll Rand compressors of 2,500 cubic feet capacity each, deliver their entire output into a 10-inch main 14 miles long, this main connecting the Las Cascadas, Empire, and Rio Grande compressor plants. In addition, two Laidlaw-Dunn-Gordon 2,200 cubic feet compressors at Balboa deliver air into a 4-mile main. During the year the combined output of these compressor plants was 8,261,199,529 cubic feet of free air, at 70° F.—the largest monthly output being 794,357,608 cubic feet. The average cost of this air delivered for the year was \$0.0324 per thousand cubic feet. In addition to the maintenance of the 14 miles of 10-inch main, 6,300 feet of this main was taken up and relaid on account of proximity to slides along the banks of the canal.

Detailed statements of the operation of this electric light and air compressor subdivision are given in exhibits marked "E" and "F," attached.

The attached data sheets, lettered from "A" to "K," inclusive, give an abstract of the principal operations performed during the past year:

Exhibit A: Abstract of expenditures.

Exhibit B: Number and class of repairs to all locomotives, and cost of same.

Exhibit C: Number and class of repairs to all cars, and cost of same.

Exhibit D: Operation of iron and brass foundries for the year.

Exhibit E: Output of air compressor plants, with cost for each month of the year.

Exhibit F: Operation of electric light plants.

Exhibit G: Number of repairs made to all classes of equipment other than locomotives and cars.

Exhibit H: Statement of all equipment hoisted and cost per month, and average cost per year.

Exhibit I: Comparison of increase in pay rolls over fiscal year 1910, account increased work handled.

Exhibit J: Number of employees on rolls at close of each month for fiscal year 1911.

Exhibit K: Statement showing percentage of overhead expense by months and average for fiscal year of 1911.

Respectfully submitted.

A. L. ROBINSON,  
*Superintendent Mechanical Division.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

## MECHANICAL DIVISION—EXHIBITS ACCOMPANYING ANNUAL STATEMENT.

EXHIBIT A.—*Abstract of expenditures, 1910–11.*

Months.	Labor.	Material.	O. D. service.	Total.
1910.				
July.....	\$122,815.60	\$102,366.04	\$8,380.08	\$233,561.72
August.....	131,289.83	105,473.12	7,513.01	244,275.96
September.....	147,439.97	127,714.19	7,103.08	282,257.24
October.....	163,972.64	126,214.65	22,900.49	313,087.78
November.....	168,433.11	92,383.24	15,703.62	276,519.97
December.....	173,373.43	122,774.88	10,855.15	307,003.46
1911.				
January.....	187,479.60	133,005.01	14,069.88	334,554.58
February.....	171,626.63	123,426.76	11,925.12	306,978.51
March.....	163,068.89	149,778.66	14,519.87	347,367.42
April.....	168,091.84	140,300.52	10,371.58	318,763.94
May.....	176,466.78	145,602.04	12,676.49	334,747.31
June.....	171,599.84	147,933.36	11,589.21	331,122.41
Total.....	1,965,680.25	1,516,972.47	147,637.58	3,630,270.30
Average per month.....	163,805.02	126,414.37	12,303.13	302,522.52

EXHIBIT B.—*Number of repairs to locomotives.*

Months.	Running repairs.	Heavy or general repairs.	Total.
1910.			
July.....	1,809	15	1,824
August.....	1,781	16	1,797
September.....	2,018	14	2,032
October.....	2,051	19	2,070
November.....	2,111	26	2,140
December.....	2,122	26	2,148
1911.			
January.....	2,225	24	2,249
February.....	2,196	10	2,206
March.....	2,465	15	2,480
April.....	2,623	14	2,637
May.....	2,786	16	2,802
June.....	2,781	11	2,792
Total.....	26,308	209	27,177

	Labor.	Material.	Total.
Cost of repairs to locomotives.....	\$293,053.19	\$126,595.91	\$419,649.10
Average cost per month.....	24,421.10	10,549.66	34,970.76
353 locomotives in service; average cost per locomotive.....	830.17	358.63	1,188.80

EXHIBIT C.—*Number of repairs to all classes of cars.*

Class of cars.	Shop. <sup>1</sup>	Field.	Total.
40-ton flats.....	12,251	96,109	108,360
Western dumps.....	1,979	38,773	40,752
Oliver dumps.....	2,559	34,960	37,519
Goodwin dumps.....	22	187	209
Ingoldsby dumps.....	14	155	170
Steel flats.....	71	714	785
Labor cars.....	142	188	330
Miscellaneous.....	184	1,194	1,378
Total.....	17,222	172,281	189,503

	Labor.	Material.	Total.
Repairs to freight cars.....	\$539,892.02	\$345,322.49	\$885,214.51
Average per month.....	44,991.01	28,776.87	73,767.88

<sup>1</sup> Includes Pedro Miguel shop repairs.

## EXHIBIT Da.—Operation of iron foundry.

Months.	Pounds output.	Cost.	Patterns made.	Number of castings.
<b>1910.</b>				
July.....	517,720	\$0.03330	115	21,474
August.....	607,725½	.03067	135	23,458
September.....	578,801	.03430	142	13,090
October.....	666,566½	.03189	153	17,442
November.....	764,258	.03004	197	20,052
December.....	796,968½	.03219	154	20,688
<b>1911.</b>				
January.....	860,365½	.03310	128	18,388
February.....	834,003	.03181	131	23,255
March.....	920,381½	.03055	108	29,795
April.....	767,544	.02710	129	13,052
May.....	759,420	.02876	116	8,254
June.....	643,929	.03270	110	16,327
<b>Total.....</b>	<b>8,715,671½</b>	<b>.03125</b>	<b>1,616</b>	<b>235,275</b>

## EXHIBIT Db.—Operation of brass foundry.

Months.	Pounds output.	Cost.	Patterns made.	Number of castings.
<b>1910.</b>				
July.....	54,821½	\$0.18230	54	2,531
August.....	50,066	.17270	50	3,835
September.....	44,406	.18280	52	1,978
October.....	34,111½	.18020	86	3,936
November.....	41,480	.18020	80	3,232
December.....	48,350½	.18160	28	2,946
<b>1911.</b>				
January.....	41,679½	.18098	55	4,334
February.....	38,103	.18100	68	2,596
March.....	23,101½	.18040	27	2,268
April.....	19,817½	.16755	24	1,718
May.....	23,103½	.16040	67	2,036
June.....	34,507½	.18820	59	4,348
<b>Total.....</b>	<b>453,548½</b>	<b>.17920</b>	<b>630</b>	<b>35,758</b>

Total number of castings made (iron and brass)..... 271,033

Total number of patterns made..... 2,246

Cost of patterns included in foundry operation.

## EXHIBIT E.—Output of air-compressor plants.

Months.	Cubic feet.	Cost.	Cost per M cubic feet.
<b>1910.</b>			
July.....	676,599,645	\$22,209.03	\$0.0328
August.....	641,244,338	20,972.43	.0327
September.....	580,923,046	19,726.95	.0340
October.....	652,448,732	21,611.58	.0331
November.....	624,779,368	20,363.28	.0326
December.....	693,268,842	22,900.16	.0330
<b>1911.</b>			
January.....	717,711,292	21,564.50	.0301
February.....	652,245,014	22,304.47	.0322
March.....	794,357,608	25,289.70	.0321
April.....	729,792,603	23,420.97	.0321
May.....	753,453,223	23,715.02	.0315
June.....	704,342,818	23,456.99	.0333
<b>Total.....</b>	<b>8,261,199,529</b>	<b>267,535.06</b>	<b>.0324</b>



**EXHIBIT F.—Operation of electric-light plants.**

Months.	Kilowatt-hour output mechanical-division plants.	Kilowatt-hour output Cristobal and Gatun plants, Atlantic division.	Total distributed.
<b>1910.</b>			
July.....	378,722	162,266	540,988
August.....	388,595	175,330	563,925
September.....	392,441	153,486	545,927
October.....	421,883	171,893	593,776
November.....	418,654	173,982	592,636
December.....	437,592	161,940	599,532
<b>1911.</b>			
January.....	1,407,253	137,840	545,083
February.....	1,439,668	135,126	574,794
March.....	419,512	150,230	569,742
April.....	418,284	146,490	564,774
May.....	401,826	172,900	574,726
June.....	396,704	169,284	565,988
Total.....	4,911,134	1,910,767	6,821,901

	16 candle-power lights or equivalent.	Arc lights.
June, 1910.....	30,818	194
June, 1911.....	32,337	187

<sup>1</sup> 124,820 kilowatt-hours furnished by Pacific division, account breakdown, Balboa plant.

**EXHIBIT G.—Repairs to equipment other than locomotives and cars.**

Months.	Cranes.	Track shifters.	Unload-ers.	Spread-ers.	Others.	Total.
<b>1910.</b>						
July.....	25	9	55	20	11	120
August.....	31	15	78	27	3	154
September.....	37	15	68	43	4	167
October.....	62	21	90	40	3	216
November.....	42	22	70	64	13	211
December.....	38	22	81	53	16	210
<b>1911.</b>						
January.....	38	15	107	60	18	238
February.....	21	11	104	44	31	211
March.....	20	2	118	18	14	172
April.....	38	6	126	19	86	275
May.....	36	5	107	25	91	264
June.....	19	7	125	25	26	232
Total.....	407	150	1,129	438	16	2,240

EXHIBIT H.—*Equipment hosted and cost per month.*

Months.	Number hosted.	Labor.	Material.	Total.	Labor average.
<b>1910.</b>					
July.....	5,924	\$5,809.88	\$583.12	\$6,393.00	\$0.981
August.....	5,932	6,024.79	740.96	6,765.75	1.016
September.....	6,597	7,171.71	1,202.51	8,374.22	1.087
October.....	6,846	7,157.97	221.56	7,379.53	1.046
November.....	6,454	6,885.02	276.26	7,161.28	1.066
December.....	6,489	6,985.46	253.79	6,979.25	1.032
<b>1911.</b>					
January.....	6,809	6,439.48	353.97	6,793.45	.946
February.....	6,286	6,308.04	604.27	6,972.31	1.013
March.....	7,236	6,448.26	534.99	6,983.25	.891
April.....	7,874	6,923.08	356.87	7,279.90	.879
May.....	8,487	7,369.83	790.80	8,160.63	.868
June.....	8,143	7,918.46	709.65	8,628.11	.972
<b>Total.....</b>	<b>83,077</b>	<b>81,209.93</b>	<b>6,658.75</b>	<b>87,868.68</b>	<b>.9775</b>

*Narrow-gauge locomotives.*

Months.	Locomotives.	Cost (labor only).	Average cost per unit.
<b>1911.</b>			
April.....	208	\$81.50	\$0.392
May.....	248	101.68	.410
June.....	239	100.38	.420
<b>Total.....</b>	<b>695</b>	<b>283.56</b>	<b>.408</b>

EXHIBIT I.—*Comparison of increase in pay rolls over 1910-11, account increased work handled.*

	Gold.	Silver.	Total.
Increase in amount of pay rolls, Gorgona shops proper, June, 1911, over June, 1910.....	\$27,226.59	\$12,512.16	\$39,738.75
Increase in amount of pay rolls, Pedro Miguel engine house, June, 1911, over June, 1910.....	\$3,503.08	\$1,419.68	\$4,922.76
Increase in amount of pay rolls, Gatun engine house, June, 1911, over June, 1910.....	\$7,092.72	\$4,068.05	\$11,160.77
Increase in force, Gorgona shops proper, June, 1911, over June, 1910.....	230	484	714
Increase in force, Pedro Miguel engine house, June, 1911, over June, 1910.....	20	41	61
Increase in force, Gatun engine house, June, 1911, over June, 1910.....	56	184	220
Force on rolls, June, 1910.....	748	1,141	1,889
Force on rolls, June, 1911.....	1,034	1,798	2,832
Total increase.....	286	657	943
Pay roll, June, 1910.....			\$122,275.38
Pay roll, June, 1911.....			\$171,594.37
Total increase.....			\$49,318.99

EXHIBIT J.—*Number of employees on pay rolls at close of each month.*

Months.	Gold.	Silver.	Total.
<b>1910.</b>			
July.....	754	1,166	1,920
August.....	780	1,219	1,999
September.....	908	1,434	2,342
October.....	1,017	1,548	2,565
November.....	1,127	1,553	2,680
December.....	1,111	1,550	2,661
<b>1911.</b>			
January.....	1,154	1,629	2,783
February.....	1,096	1,649	2,745
March.....	1,104	1,602	2,706
April.....	1,050	1,853	2,903
May.....	1,061	1,861	2,922
June.....	1,034	1,798	2,832
Average.....	1,016	1,572	2,588

EXHIBIT K.—*Percentage of overhead expense.*

	Percent.
1910—July.....	28.90
August.....	23.80
September.....	32.52
October.....	31.18
November.....	32.21
December.....	34.56
1911—January.....	38.31
February.....	38.10
March.....	32.70
April.....	33.13
May.....	29.05
June.....	31.70
Average.....	32.42

NOTE.—In addition to usual plant operation, superintendence, etc., "Overhead expense" of the Isthmian Canal Commission includes plant account, gratuity time for holidays, sick leave, vacation, injury, transit, reporting, band practice, and fire-drill time.

## APPENDIX H.

### **REPORT OF C. M. SAVILLE, ASSISTANT ENGINEER, IN CHARGE OF THE THIRD DIVISION OF THE OFFICE OF THE CHIEF ENGINEER.**

ISTHMIAN CANAL COMMISSION,  
THIRD DIVISION, OFFICE OF THE CHIEF ENGINEER,  
*Culebra, Canal Zone, July 31, 1911.*

SIR: I have the honor to submit the following report on the operations of the third division, office of the chief engineer, for the fiscal year ended June 30, 1911:

Only slight changes have been made in the personnel since the last report, the work for the fiscal year being under the direction of the following assistants:

Clerical: Chief clerk (acting), Mr. D. F. Pyne.

Meteorological and hydrographic: Inspector, Mr. F. D. Willson; principal meteorologist, Mr. H. G. Cornthwaite; principal hydrographer (acting), Mr. H. F. French, to August 24, 1910; Mr. M. T. Rogers, from August 25, 1910.

General surveys and explorations: In charge of field work, Mr. R. R. Wiggins, assistant engineer; in charge of office work, Mr. Malcolm Elliott, assistant engineer, to September 9, 1910; Mr. P. H. Underwood, assistant engineer, from February 16, 1911.

#### **METEOROLOGY.**

The three first-class stations named in the last annual report, Ancon, Culebra, and Cristobal, are still maintained, each with a full complement of instruments. There are now three second-class stations—Gatun, Pedro Miguel, and Gamboa—at which wind direction and velocity, temperature and rainfall are recorded. Twenty rainfall stations are in operation, 12 of which are equipped with standard and 8 with automatic rain gauges, and in addition semimonthly rain gauges are installed at the headwaters of the Pedro Miguel, Siri Grande, Cano, and the Chilibre Rivers.

In order to study wind conditions at Gamboa for the purpose of compiling data for future use in connection with the navigation of the canal, an anemometer was erected at that point. At the request of the department of sanitation, an anemometer was erected at Corozal in February, 1911, for use in connection with studies concerning mosquito migration.

For the purpose of determining the effects of varied conditions on evaporation from the lake surfaces, three evaporation pans, each equipped with a standard rain gauge and two of them with anemometers, were installed in Gatun Lake in the vicinity of Gatun, one in an exposed location in the open part of the lake about 1,000 feet from shore, the second among the trees and scrub near the lake border, and a third in an extensive patch of tall rushes. Evaporation

stations are also maintained at Ancon, Cristobal, Rio Grande Reservoir, and Brazos Brook Reservoir.

An automatic tide register was installed in the canal at station 2,155 opposite Corozal, in addition to those previously in operation at Balboa and Cristobal. At the two latter places automatic records are also kept of the sea temperature.

Two seismograph stations are in operation for the purpose of recording seismic disturbances of far or near occurrence. The station at Ancon is equipped with two 100-k Bosch-Omori instruments, while that at Gatun has two 25-k machines of the same type. The seismograph station on Guarapo Island in Gatun Lake near the spillway of Gatun Dam, was erected this year and the two 25-k seismographs formerly located at Ancon Observatory were removed to the new station in April, 1911. At the close of the year these instruments were still in process of adjustment.

#### TEMPERATURE.

The average temperature for the year 1910 was about normal at all the stations, and there was practically no difference between the rainy season and the dry season averages, though the daily range was much greater in the dry season. The highest temperature recorded during the year was 94° F. at Ancon on March 13, 1910, and the lowest was 61° F. at Culebra on March 21, 1910. The following table shows the absolute maximum and minimum temperatures of record at the three first-class stations:

*Absolute temperatures of record.*

Stations.	Maximum.		Minimum.	
	Date.	° F.	Date.	° F.
Ancon.....	Mar. 20, 1908	96	Jan. 27, 1910	63
Culebra.....	Apr. 15, 1909	94	Mar. 21, 1910	61
Cristobal.....	June 3, 1909	92	Dec. 3, 1909	66

NOTE.—The lowest temperature recorded on the Isthmus since records have been kept was 59° F. at Bas Obispo on Feb. 9, 1907.

The average daily maximum temperature in the sun at Culebra during 1910 was 91° F., 6° higher than in the shade, the absolute maximum being 98° F. on March 12 and August 31. The absolute maximum temperature in the sun at Culebra since records have been kept was 105° F., registered May 15, 1909.

The monthly maximum, minimum, and mean temperatures at the first-class stations are shown in Table 1.

#### RAINFALL.

The average rainfall over the Canal Zone for the year 1910 was well above normal, being unusually heavy in July and December, but was below that of the previous year. For the first half of 1911 the rainfall was below normal, that for June being especially light except in the Atlantic section. The dry season rainfall in 1910 was above normal, especially in the Atlantic section, being 15 per cent of the total

amount for the year in this section, 10 per cent in the Pacific section, and 12 per cent in the central section. There was a marked deficiency in precipitation during the dry season of 1911.

The average annual rainfall for 1910 was 90.83 inches in the Pacific section, 129.18 inches in the central section, and 157.86 inches in the Atlantic section. The average number of rainy days was 220 in the Pacific section, 271 in the central section, and 292 in the Atlantic section, the greatest number being 344 at Monte Lirio and the least, 211, at Balboa.

The monthly and accumulated rainfall, January 1, 1910, to June 30, 1911, and the station average for the years of record at the various stations are shown in Table 2.

The maximum rainfall in 1910 for periods of 5 minutes, 1 hour, and 24 hours is shown in the following table:

Periods.	Amount.	Stations.	Date.
	<i>Inches.</i>		
5 minutes.....	0.60	Rio Grande.....	July 29
1 hour.....	3.82	Gatun.....	May 26
24 hours.....	7.19	Porto Bello.....	Jan. 5-6

The maximum rainfall of record at various stations for similar periods is shown in Table 3.

#### HUMIDITY.

Conditions regarding relative humidity during the year 1910 were normal in all sections of the Canal Zone, the monthly values being shown in attached Table 5.

#### ATMOSPHERIC PRESSURE.

The range of atmospheric pressure in February, 1911, was unusual, the highest and lowest pressures of record, 30.029 at Cristobal and 29.695 at Ancon, occurring during the month. Barometric readings were also exceptionally high in March, 1911, the average at each station being the highest of record for that month. The maximum, minimum, and mean readings for each month of the year 1910 are shown in Table 6.

#### WIND.

There was a general excess in wind movement during the year 1910, and the average velocity was much greater in the dry than in the rainy season. The average hourly wind movement, prevailing direction, and maximum velocity for 5 minutes at the first-class stations are shown by months in Table 7.

The weather on the Isthmus was noticeably affected during the middle and latter part of the month of October, 1910, by the passage of a hurricane of unusual severity over the West Indian and Gulf regions. This abnormal depression over the West Indies, and the resulting steep barometric pressure gradient toward the northeast, caused a general reversal of the wind direction over the Isthmus during the second decade of the month. Brisk southerly winds and generally fair weather prevailed during this period. Heavy rains

occurred later in the month following the reestablishment of normal pressure conditions. By consulting Table 7 it may be seen that October was the only month during the year in which the prevailing wind direction at Ancon and Culebra was other than northwest.

The maximum velocities of record at the first-class stations for 5-minute periods are as follows:

*Maximum velocity.*

Stations.	Miles per hour.	Direction.	Date.
Ancon.....	59	South.....	July 10, 1909
Culebra.....	39	North.....	July 20, 1910
Cristobal.....	40	South.....	July 16, 1908

CLOUDINESS.

Conditions regarding cloudiness during the year 1910 were normal.

EVAPORATION.

Evaporation records were continued at the regular stations, and the monthly data are shown in Table 8.

FOGS.

There was a decrease in the number of fogs observed during the year. The record of the number and duration of the fogs observed at the various stations along the canal prism is shown in Table 9.

SEA TEMPERATURE.

The temperature of the surface sea water on the Atlantic coast has been quite uniform throughout the year. The average temperature is about 81° F. On the Pacific coast the average is about 80° F., but the extreme range is much greater than on the Atlantic coast, as there is a decided drop during the dry season, due to the presence, at this season of the year, of a comparatively cool ocean current. The lowest water temperature recorded at Balboa during the past three years was 60° F. in February, 1910, and the lowest recorded at Cristobal during the same period was 75° F. in January, 1910. The monthly means and extremes in sea temperature at Balboa and Cristobal during the year 1910 are shown in Table 10.

The tidal extremes of record at Balboa and Cristobal are as follows:

Stations.	Maximum high water.		Extreme low water.	
	Elevation.	Date.	Elevation.	Date.
Balboa.....	+11.2	Oct. 2, 1909	-10.6	Apr. 11, 1910
Cristobal.....	+ 1.65	Nov. 27, 1909	- 1.01	June 9, 1910

Elevations in feet referred to mean sea level.

Stations.	Maximum range.		Minimum range.	
	Feet.	Date.	Feet.	Date.
Balboa.....	20.8	Apr. 11, 1910	5.1	Mar. 24, 1911
Cristobal.....	2.17	June 28, 1911	( <sup>1</sup> )	.....

<sup>1</sup> One tidal fluctuation often entirely absent at Cristobal.

Tidal conditions on the Atlantic and Pacific coasts for the year 1910 are shown in Table 11.

#### OCEAN METEOROLOGY.

The collection of data for the compilation of a synoptic chart for the use of vessels entering and leaving the canal has been continued through the year.

#### SEISMOLOGY.

The seismographs at Ancon registered a considerable number of seismic disturbances during the past year, the greater part of which were of insufficient intensity to be sensibly felt in the Canal Zone, many being merely slight tremors resulting from distant quakes. The more important shocks were as follows:

Dates.	Maximum amplitude.	Remarks.
	<i>Mms.</i>	
July 17, 1910.....	15	
Sept. 24, 1910.....	42	
Dec. 21, 1910.....	75	Pens off.
Apr. 10, 1911.....	55	Do.
June 7, 1911.....	7.5	Destructive Mexican earthquake.

NOTE.—The amplitude indicates half the complete range of maximum motion. In previous reports it indicated the complete range.

The shocks of September 24 and December 21, 1910, and April 10, 1911, although sensibly observed by a few persons in the Canal Zone, were of insufficient energy to be generally appreciable.

A complete list of the seismic disturbances recorded at Ancon during the year will be found in Tables 12 and 13.

The following plates accompany the report of this section:

PLATE 120.—Rainfall along canal location.

PLATE 121.—Monthly rainfall by sections.

PLATE 122.—Wind roses, dry season and rainy season, year 1910.

The following tables accompanying the report of this section are appended:

TABLE 1.—Air temperature, Canal Zone, year 1910.

TABLE 2.—Rainfall on the Isthmus of Panama.

TABLE 3.—Maximum rainfall in Canal Zone.

TABLE 4.—Hourly distribution of rainfall on Canal Zone.

TABLE 5.—Canal Zone meteorological summary.

TABLE 6.—Atmospheric pressure, year 1910.

TABLE 7.—Wind direction and velocity, Canal Zone, year 1910.

TABLE 8.—Evaporation in Canal Zone.

TABLE 9.—Fogs along the canal prism, year 1910.

TABLE 10.—Sea temperature, year 1910.

TABLE 11.—Tidal conditions, year 1910.

TABLE 12.—Seismic disturbances recorded at Ancon, Canal Zone.

TABLE 13.—Seismic disturbances recorded at Ancon, Canal Zone.



TABLE I.—Air temperature, Canal Zone, 1910.

Months.	Ancon.				
	Maxi- mum.	Date.	Mini- mum.	Date.	Month- ly mean.
	° F.		° F.		° F.
January.....	90	Fourteenth.....	63	Twenty-seventh...	78.8
February.....	92	Twenty-first.....	67	Eleventh.....	79.6
March.....	94	Thirteenth.....	65	Tenth.....	79.4
April.....	92	Fourth.....	70	Second.....	80.4
May.....	92	Ninth.....	69	Twenty-ninth.....	79.2
June.....	90	Twenty-sixth.....	71	Seventeenth.....	79.3
July.....	91	Twentieth.....	67	do.....	78.3
August.....	91	Fifteenth.....	69	Twenty-first.....	79.2
September.....	92	Seventeenth.....	70	Fourteenth.....	78.7
October.....	90	Thirtieth.....	70	Thirtieth.....	78.5
November.....	89	Eighteenth.....	70	First.....	79.0
December.....	91	Thirtieth.....	68	Twenty-ninth.....	79.2
Year.....	94	Mar. 13.....	63	Jan. 27.....	79.1

Months.	Culebra.				
	Maxi- mum.	Date.	Mini- mum.	Date.	Month- ly mean.
	° F.		° F.		° F.
January.....	86	Thirteenth.....	63	Twenty-seventh...	76.8
February.....	90	Twenty-eighth.....	67	Second.....	77.5
March.....	90	Fourth.....	61	Twenty-first.....	77.4
April.....	91	Twenty-fourth.....	69	Tenth.....	79.4
May.....	90	Twenty-ninth.....	68	Twenty-ninth.....	78.6
June.....	92	Sixth.....	70	Seventeenth.....	78.9
July.....	89	First.....	67	do.....	77.4
August.....	89	Seventh.....	69	Sixth.....	78.8
September.....	89	do.....	69	Second.....	78.6
October.....	89	Second.....	69	First.....	79.0
November.....	88	Sixteenth.....	69	Twelfth.....	77.9
December.....	87	Twenty-third.....	68	Twenty-eighth.....	77.4
Year.....	92	June 6.....	61	Mar. 21.....	78.1

Months.	Cristobal.				
	Maxi- mum.	Date.	Mini- mum.	Date.	Month- ly mean.
	° F.		° F.		° F.
January.....	82	Fourth.....	70	Twenty-eighth.....	77.6
February.....	82	Twenty-first.....	71	Third.....	77.8
March.....	83	Thirty-first.....	67	Twenty-first.....	77.5
April.....	84	Twenty-fourth.....	73	Tenth.....	79.4
May.....	87	do.....	71	Twenty-ninth.....	79.0
June.....	89	Thirteenth.....	73	Seventeenth.....	79.3
July.....	86	Seventeenth.....	70	do.....	77.6
August.....	86	Thirty-first.....	72	Twentieth.....	78.4
September.....	83	Fifteenth.....	71	Thirtieth.....	78.6
October.....	89	First.....	70	Twenty-fifth.....	78.6
November.....	88	Fourteenth.....	71	Twelfth.....	77.8
December.....	82	Thirty-first.....	71	Thirtieth.....	77.4
Year.....	89	June 13.....	67	Mar. 21.....	78.2

TABLE 2.—Rainfall on the Isthmus of Panama, year 1910, January to June, 1911, and station averages.

Station and years of record.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.	Current month.	Accum. lated.
Ancon:																								
1910.....	1.22	1.22	0.43	1.45	1.83	3.48	3.71	7.19	9.30	17.08	8.82	26.90	9.28	36.16	12.00	47.16	4.84	52.00	8.86	60.86	4.20	65.15	10.63	75.78
1911.....	0.83	0.83	2.76	3.89	2.26	3.94	6.34	10.18	11.04	21.22	3.40	24.62	8.18	30.77	7.64	38.41	7.40	45.90	10.43	56.33	10.94	67.27	4.40	71.67
Average (13 years).....	1.12	1.12	1.59	1.85	2.05	3.71	6.54	5.24	8.66	13.90	6.09	22.50	8.68	22.50	9.84	33.00	6.17	28.67	9.64	35.97	10.94	46.21	7.40	53.61
Balboa:																								
1910.....	0.97	0.97	0.46	1.43	2.16	3.59	3.63	7.22	8.88	16.10	10.44	26.54	8.90	35.44	10.85	46.29	6.18	51.46	9.94	61.54	3.97	65.51	9.79	75.30
1911.....	0.86	0.86	2.22	3.00	0.00	3.00	7.30	10.99	8.55	19.84	4.23	24.07	8.36	24.07	10.11	31.96	7.54	39.50	6.36	45.86	9.12	54.98	6.45	71.06
Average (12 years).....	1.28	1.28	1.34	1.94	1.00	3.29	6.54	6.94	9.34	13.49	8.36	24.07	9.50	27.30	11.19	31.96	7.54	39.50	6.36	45.86	9.12	54.98	6.45	71.06
Miraflores:																								
1910.....	3.88	3.88	2.02	5.90	2.40	8.09	5.15	13.24	10.26	23.63	13.79	37.42	11.31	48.73	11.97	60.70	9.56	70.26	13.40	83.66	10.20	93.86	8.71	102.57
1911.....	3.77	3.77	2.43	6.13	2.70	8.89	6.56	15.72	10.16	15.72	3.71	19.43	10.70	30.13	9.22	56.96	10.70	67.65	13.26	80.91	13.34	94.25	10.88	105.13
Average (2 years).....	3.88	3.88	2.23	6.02	2.55	8.49	5.90	14.48	11.71	19.68	16.06	28.48	11.01	39.43	10.60	56.96	10.70	67.65	13.26	80.91	13.34	94.25	10.88	105.13
Pedro Miguel:																								
1910.....	1.82	1.82	1.60	2.22	1.46	3.78	5.16	8.94	13.24	22.18	14.42	36.60	8.96	45.56	10.08	55.63	7.08	63.71	13.42	76.13	10.02	86.15	9.61	96.36
1911.....	0.08	0.08	1.40	1.48	0.08	1.46	6.24	6.70	9.57	16.27	6.52	21.79	9.22	30.98	9.82	49.80	8.40	58.20	13.10	71.30	13.02	84.41	10.38	94.80
Average (3 years).....	1.04	1.04	1.26	2.89	0.72	3.61	2.88	6.40	12.16	18.65	12.11	30.76	9.22	30.98	9.82	49.80	8.40	58.20	13.10	71.30	13.02	84.41	10.38	94.80
Rio Grande:																								
1910.....	1.65	1.65	1.00	2.65	1.09	4.24	5.36	9.70	10.90	20.66	11.69	32.35	16.76	46.99	10.11	57.10	10.09	67.19	13.51	80.70	10.81	91.51	11.86	103.37
1911.....	0.02	0.02	0.91	0.93	0.08	0.99	6.86	7.55	16.80	24.74	4.03	28.77	12.03	39.20	10.22	49.42	11.20	60.71	13.11	73.82	11.30	85.21	7.02	92.23
Average (6 years).....	1.70	1.70	0.96	2.46	0.52	2.90	3.06	8.63	10.54	16.49	10.68	27.17	12.03	39.20	10.22	49.42	11.20	60.71	13.11	73.82	11.30	85.21	7.02	92.23
Culebra:																								
1910.....	1.21	1.21	0.88	2.24	1.26	3.60	5.35	8.96	10.50	19.45	11.16	30.61	16.28	46.99	10.11	57.10	10.09	67.19	13.51	80.70	10.81	91.51	11.86	103.37
1911.....	0.02	0.02	0.74	0.76	0.08	0.82	5.71	14.86	20.57	4.25	24.82	9.17	34.05	10.70	47.54	11.35	58.89	11.35	70.24	12.52	82.76	8.19	90.95	
Average (20 years).....	1.02	1.02	0.81	1.50	0.64	2.21	3.78	7.01	11.12	18.12	10.67	27.29	12.03	39.20	10.22	49.42	11.20	60.71	13.11	73.82	11.30	85.21	7.02	92.23
Canas:																								
1910.....	2.00	2.00	1.20	3.20	2.26	5.75	6.92	12.67	12.68	24.72	12.11	36.83	16.17	53.00	10.75	63.76	11.78	76.46	17.20	92.68	13.15	105.83	11.65	117.48
1911.....	0.04	0.04	0.73	0.73	0.82	1.33	6.98	7.40	18.11	25.95	4.62	30.57	12.07	42.67	11.93	47.54	11.35	58.89	11.35	70.24	12.52	82.76	8.19	90.95
Average (4 years).....	1.77	1.77	0.96	2.46	1.54	4.04	4.45	9.54	10.40	17.40	12.07	28.47	14.08	39.80	10.84	61.64	11.35	62.98	13.71	76.69	14.70	91.30	8.34	99.73
Empire:																								
1910.....	0.70	0.70	0.75	1.45	1.60	3.05	4.24	7.20	11.08	18.37	10.14	28.51	12.60	41.11	10.08	51.19	8.90	60.18	12.57	72.75	8.85	81.60	9.06	90.66
1911.....	0.02	0.02	0.55	0.57	0.20	0.77	3.93	4.34	13.74	18.44	6.92	24.36	10.24	34.56	10.14	44.30	7.98	52.23	14.16	66.39	11.49	77.88	6.61	84.40
Average (5 years).....	1.02	1.02	0.65	1.51	0.90	1.92	4.07	5.77	12.61	20.37	8.57	23.92	10.24	24.16	10.14	44.30	7.98	52.23	14.16	66.39	11.49	77.88	6.61	84.40
Gambos:																								
1910.....	1.24	1.24	1.80	3.04	3.12	6.16	3.85	10.01	11.09	21.10	12.08	33.18	17.00	50.18	10.66	60.84	12.24	73.08	12.90	85.98	16.90	102.88	13.11	115.99
1911.....	1.11	1.11	0.73	1.83	1.20	3.81	4.01	8.02	14.53	19.74	6.98	26.72	10.42	36.56	12.20	50.56	10.61	61.17	12.77	73.94	12.54	86.48	7.31	93.79
Average (28 years).....	1.98	1.98	1.85	2.93	2.66	5.00	3.93	9.01	10.89	18.22	9.53	27.94	10.42	38.36	12.20	50.56	10.61	61.17	12.77	73.94	12.54	86.48	7.31	93.79
Alhajuela:																								
1910.....	2.99	2.99	2.58	5.57	2.74	8.31	2.99	11.30	11.50	22.80	13.62	36.42	16.99	53.41	13.43	66.84	18.44	85.28	15.37	100.65	14.87	115.52	15.49	131.01
1911.....	1.14	1.14	2.20	2.43	0.01	2.44	4.88	7.23	16.11	23.03	10.53	33.96	13.13	46.07	13.29	59.36	12.03	71.39	13.53	84.90	14.70	99.10	8.04	107.14
Average (11 years).....	1.44	1.44	2.39	4.00	1.38	5.38	3.34	9.26	12.38	18.60	13.13	35.19	13.85	46.58	13.29	58.87	12.03	76.87	13.53	84.90	14.70	99.10	8.04	107.14

TABLE 2.—Rainfall on the Isthmus of Panama, year 1910, January to June, 1911, and station averages—Continued.

Station and years of record.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.	Current month.	Accumulated.
El Vigia:	0.68	3.09	2.41	3.09	2.95	6.04	2.33	8.37	10.47	18.84	12.02	30.86	15.17	46.03	15.01	61.04	17.86	78.90	16.90	96.80	14.20	110.00	16.01	126.01
	2.20	3.19	3.39	3.04	3.43	6.83	3.40	6.83	10.62	17.45	12.11	29.56	14.63	52.01	13.12	65.13	15.39	80.52	17.21	97.73	20.64	118.37	10.20	128.57
	Average (2 years).....	2.30	3.64	5.94	7.58	3.67	12.16	5.79	12.16	8.06	20.22	12.91	33.13	13.48	46.61	10.94	57.45	13.31	70.76	13.33	84.09	11.54	96.63	15.71
Gorgona:	1.00	1.79	3.39	2.98	2.98	6.37	5.79	12.16	8.06	20.22	12.91	33.13	13.48	46.61	10.94	57.45	13.31	70.76	13.33	84.09	11.54	96.63	15.71	111.34
	4.43	4.33	1.99	2.42	3.36	3.16	3.16	7.94	12.20	19.81	9.02	28.83	11.99	40.82	12.37	53.19	13.17	66.36	13.10	79.46	14.37	93.83	8.41	102.24
	Average (6 years).....	2.37	3.76	3.13	3.30	4.43	3.16	7.94	12.20	19.81	9.02	28.83	11.99	40.82	12.37	53.19	13.17	66.36	13.10	79.46	14.37	93.83	8.41	102.24
San Pablo:	2.21	2.87	5.08	4.47	9.55	6.52	16.07	9.93	26.00	10.38	36.38	18.30	54.68	13.06	67.74	15.92	83.66	16.88	100.54	13.15	113.69	19.65	133.34	
	5.53	1.12	1.65	1.55	2.20	3.82	6.02	10.25	16.27	5.47	21.74	31.67	12.21	43.86	10.94	54.80	12.72	67.52	16.14	83.66	15.14	98.80	9.88	108.68
	Average (3 years).....	2.37	1.57	3.94	1.81	5.75	5.14	10.89	10.09	20.98	10.67	31.67	24.98	12.21	43.86	10.94	54.80	12.72	67.52	16.14	83.66	15.14	98.80	9.88
Tabernilla:	2.26	2.19	4.45	5.44	9.89	6.29	16.18	9.15	25.33	10.15	35.48	15.44	50.92	11.07	61.99	19.17	81.16	14.72	96.88	13.04	108.92	17.72	126.64	
	0.08	0.99	1.07	0.66	1.73	4.66	6.39	10.53	16.92	4.81	21.73	33.68	10.43	44.11	10.80	54.91	14.41	69.32	18.19	87.51	16.38	103.89	9.85	113.74
	Average (3 years).....	2.59	1.80	4.39	2.39	6.78	4.99	11.77	11.34	23.11	10.57	33.68	22.46	10.43	44.11	10.80	54.91	14.41	69.32	18.19	87.51	16.38	103.89	9.85
Bohio:	4.02	0.89	10.91	6.60	17.51	6.46	23.97	14.14	38.11	11.75	49.86	20.82	70.68	14.84	85.52	16.82	102.34	14.53	116.87	22.37	139.24	21.30	160.54	
	3.22	1.87	2.19	2.07	3.16	4.87	8.03	12.32	20.35	6.96	27.31	42.82	13.37	56.19	15.34	71.53	14.02	85.55	16.80	102.35	19.39	121.74	11.25	132.99
	Average (16 years).....	6.36	2.13	8.51	2.06	40.69	8.64	16.43	13.93	30.36	12.46	42.61	37.31	13.37	56.19	15.34	71.53	14.02	85.55	16.80	102.35	19.39	121.74	11.25
Trinidad:	4.28	5.97	10.25	8.18	18.43	9.28	27.71	11.21	38.92	11.11	50.03	14.91	64.94	12.03	76.97	16.19	93.16	16.30	109.46	22.95	132.41	21.64	154.06	
	6.64	2.00	2.64	2.33	4.97	6.55	19.32	18.20	26.50	8.79	35.29	44.60	10.72	55.32	13.51	68.83	14.21	83.04	14.49	97.53	23.47	121.00	15.79	136.79
	Average (3 years).....	4.86	4.06	3.70	8.56	4.41	12.97	6.55	19.32	13.47	32.99	11.61	44.60	10.72	55.32	13.51	68.83	14.21	83.04	14.49	97.53	23.47	121.00	15.79
Monte Lirio:	4.29	8.93	13.22	9.57	22.79	7.01	29.80	11.84	41.64	16.30	57.94	19.87	77.81	13.68	91.49	22.22	113.71	16.46	130.17	25.60	155.77	22.96	179.73	
	8.89	2.41	3.30	1.41	4.71	5.27	9.98	19.70	26.68	11.41	49.28	19.04	68.32	13.85	82.17	12.72	94.89	16.02	110.91	26.06	136.97	19.24	156.21	
	Average (3 years).....	5.01	6.33	10.34	5.71	16.05	5.71	16.05	5.71	16.05	5.71	16.05	5.71	16.05	5.71	16.05	5.71	16.05	5.71	16.05	5.71	16.05	5.71	16.05
Gatun:	4.81	3.83	8.14	9.08	17.22	4.97	22.19	15.96	37.87	11.41	49.28	19.04	68.32	13.85	82.17	12.72	94.89	16.02	110.91	26.06	136.97	19.24	156.21	
	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Average (6 years).....	4.75	2.44	7.19	3.49	10.68	3.64	14.32	15.39	29.71	13.38	43.49	13.06	56.77	16.10	72.87	10.91	83.78	16.91	100.69	24.08	124.72	15.88	140.55
Brasos Brook:	4.08	3.20	7.33	9.71	17.04	5.59	22.63	11.37	33.90	11.86	45.76	22.01	67.77	13.56	81.33	12.21	93.54	12.22	105.76	20.28	135.04	20.15	155.19	
	1.00	1.00	2.03	1.30	4.33	3.90	8.23	19.62	28.19	15.03	42.16	16.06	44.25	17.45	59.61	15.24	74.85	12.31	87.16	14.70	101.92	26.43	128.35	
	Average (4 years).....	4.87	4.57	2.38	7.25	4.40	11.65	3.90	15.21	11.92	27.13	15.03	42.16	16.06	44.25	17.45	59.61	15.24	74.85	12.31	87.16	14.70	101.92	26.43
Cristobal:	2.94	3.68	5.52	5.46	11.98	3.20	15.28	12.09	27.37	13.63	41.00	21.07	62.07	14.93	77.00	12.06	89.06	15.65	104.70	30.04	134.74	15.20	149.94	
	0.99	1.81	1.46	1.41	2.80	3.06	7.27	17.13	24.40	15.88	39.96	37.01	62.07	14.93	77.00	12.06	89.06	15.65	104.70	30.04	134.74	15.20	149.94	
	Average (40 years).....	4.13	4.13	1.46	1.70	7.28	4.19	11.47	12.31	22.78	13.23	37.01	16.50	53.51	15.22	68.73	12.56	81.29	14.15	96.44	22.01	117.48	12.58	130.03

Porto Bello:																								
1910.	14.06	5.90	19.94	6.32	26.26	7.14	33.40	9.30	42.70	15.25	57.95	22.80	80.75	20.71	101.46	13.15	114.61	9.54	124.15	23.08	147.23	22.98	170.12	
1911.	.84	.84	6.90	7.74	3.88	10.12	6.60	16.72	19.26	35.97	18.04	54.01												
Average (3 years).	12.57	12.57	4.74	17.31	3.60	20.91	8.56	29.47	13.34	42.81	16.65	59.46	19.70	76.16	17.17	96.33	11.91	108.24	8.51	116.75	31.83	146.60	30.07	178.67
Nombre de Dicos:																								
1910.	9.57	4.90	13.97	1.04	5.87	11.70	16.74	26.44	12.65	41.09	17.10	9.63	6.90	9.63	6.90	5.01	14.99	5.01	14.99	21.51				
1911.	1.51	1.51	3.26	4.79																				
Average (3 years).	13.93	13.93	6.62									17.02	10.80	7.31	11.80	20.30	22.43							

NOTE.—Values are in inches and station averages and years of record for this report all records were used. In previous reports only unbroken years' records were counted.

TABLE 3.—*Maximum rainfall in Canal Zone, Oct. 1, 1905, to June 30, 1911.*

Stations.	Maximum rainfall.					
	5 minutes.		1 hour.		24 hours. <sup>1</sup>	
	Inches.	Date.	Inches.	Date.	Inches.	Date.
Ancon (Oct. 1, 1905).....	0.64	Aug. 7, 1908	2.89	Aug. 7, 1908	6.37	Nov. 16-17, 1906.
Balboa (June 10, 1906).....	.63	do.....	5.86	June 2, 1908	7.57	Do.
Pedro Miguel (Jan. 1, 1908)...	.60	Nov. 11, 1908	3.30	Aug. 27, 1908	4.56	Sept. 30-Oct. 1, 1909.
Rio Grande (Dec. 29, 1905)...	.75	July 24, 1908	2.74	Apr. 25, 1911	6.00	Dec. 2-3, 1906.
Culebra (July 1, 1906).....	.64	May 2, 1908	3.69	Oct. 16, 1907	5.55	Dec. 3, 1906. <sup>2</sup>
Empire (July 18, 1906).....	.60	July 25, 1906	3.63	Oct. 1, 1909	6.15	Do.
Camboa (Nov. 18, 1905).....	.59	July 27, 1908	3.32	May 11, 1911	6.56	Dec. 2-3, 1906.
Alhajuela (Mar. 31, 1907)...	.60	July 20, 1909	3.40	Dec. 28, 1909	8.19	Dec. 3, 1906. <sup>2</sup>
San Pablo (Nov. 1, 1907)...	.60	Oct. 29, 1908	3.10	Oct. 29, 1908	5.14	Nov. 11-12, 1909.
Tabernilla (Nov. 1, 1907)...	.50	Oct. 31, 1909	3.09	Aug. 18, 1908	6.22	Sept. 4-5, 1910.
Bohio (Oct. 1, 1905).....	.67	June 16, 1909	4.51	Aug. 7, 1908	8.85	Aug. 7-8, 1908.
Gatun (Aug. 24, 1907).....	.61	July 16, 1908	3.82	May 26, 1910	10.48	Dec. 3, 1906. <sup>2</sup>
Cristobal (Oct. 1, 1905).....	.64	Aug. 25, 1909	4.90	Oct. 8, 1909	8.53	Dec. 2-3, 1906.
Porto Bello (May 1, 1908)...	.64	Aug. 7, 1908	3.77	Aug. 7, 1908	10.86	Dec. 23-29, 1909.

NOTE.—Dates in parentheses under station names refer to installation of automatic rainfall registers.

<sup>1</sup> Maximum rainfall for any 24 consecutive hours. In previous reports the maximum for the observation day was recorded.

<sup>2</sup> No automatic record on this date. Total for 24 hours ending at noon.

TABLE 4.—*Hourly distribution of rain fall on Canal Zone, year 1910.*

Stations.	Total rainfall.	Rainfall during working hours 7 a. m. to 5 p. m.		Maximum rainfall.		Minimum rainfall.	
		Amount.	Per cent of total.	Hour of maximum.	Accumulated amount.	Hour of minimum.	Accumulated amount.
	<i>Inches.</i>	<i>Inches.</i>			<i>Inches.</i>		<i>Inches.</i>
Balboa.....	75.30	42.08	56	2 to 3 p. m....	10.02	10 to 11 p. m....	0.80
Pedro Miguel.....	96.86	63.48	66	do.....	15.21	12 p. m. to 1 a. m.	.63
Culebra.....	103.37	72.96	71	do.....	15.61	do.....	.44
Gamboa.....	115.99	79.79	69	do.....	15.51	11 to 12 p. m....	.97
Tabernilla.....	126.64	73.88	58	3 to 4 p. m....	16.29	10 to 11 p. m....	1.32
Bohio.....	160.54	102.24	64	1 to 2 p. m....	18.55	11 to 12 p. m....	1.92
Gatun.....	156.21	81.64	52	3 to 4 p. m....	13.49	8 to 9 p. m....	3.29
Cristobal.....	149.94	66.84	45	do.....	10.75	do.....	2.43

TABLE 5.—*Canal Zone meteorological summary, year 1910.*

Stations.	Mean reduced pressure.				Temperature.				Mean relative humidity.				Total rainfall.				Mean cloudiness (tenths of whole sky).			Wind.							
	Maximum.	Date.	Minimum.	Date.	Annual mean.	° F.		Annual range.	Dry season.	Rainy season.	Annual.	Dry season.	Rainy season.	Annual.	Dry season.	Rainy season.	Annual.	Dry season.	Rainy season.	Total in over-ment.	Prevailing direction.	Rainy season.	Total in over-ment.	Prevailing direction.	Miles per hour.	Direction.	Date.
						° F.	° F.																				
Pacific section (Ancon).....	29.853	94	Mar. 13	63	Jan. 27	79	15	79	80	91	89	7.19	68.59	75.78	6.8	7.1	7.0	26,323	NW.	37,815	NW.	31	NE.	Aug. 19			
Central section (Culebra).....	29.863	92	June 6	61	Mar. 21	78	14	78	87	94	91	8.95	94.42	103.37	5.8	7.9	7.2	26,850	NW.	33,239	NW.	39	N.	July 20			
Atlantic section (Cristobal).....	29.869	89	June 13	67	do.....	78	8	78	84	90	83	15.28	134.66	146.94	4.9	7.2	6.4	40,173	N.	45,980	SE.	38	N.	Dec. 3			

TABLE 6.—*Atmospheric pressure, Canal Zone, year 1910.*

[Pressure in inches, reduced to sea level.]

Months.	Ancon.				
	Maximum.	Date.	Minimum.	Date.	Monthly mean.
January.....	29.932	Twenty-sixth...	29.803	Fourteenth.....	29.864
February.....	29.994	Sixth.....	29.770	Twenty-eighth...	29.872
March.....	30.007	Eighteenth.....	29.791	Third.....	29.884
April.....	29.989	Thirtieth.....	29.785	Twenty-third...	29.844
May.....	29.966	Twenty-third...	29.758	Tenth.....	29.864
June.....	29.917	Third.....	29.779	Twentieth.....	29.844
July.....	29.915	Eighteenth.....	29.784	Twenty-sixth...	29.850
August.....	29.928	Seventh.....	29.752	Thirtieth.....	29.842
September.....	29.907	Thirtieth.....	29.769	Third.....	29.836
October.....	29.927	Twenty-second...	29.760	Seventeenth.....	29.852
November.....	29.887	Second.....	29.760	Twenty-eighth...	29.830
December.....	29.944	Twenty-second...	29.787	Fifth.....	29.856
Year.....	30.007	Mar. 18.....	29.752	Aug. 30.....	29.853

Months.	Culebra.				
	Maximum.	Date.	Minimum.	Date.	Monthly mean.
January.....	29.940	Twenty-sixth...	29.823	Fifteenth.....	29.878
February.....	30.004	Seventh.....	29.788	Twenty-eighth...	29.886
March.....	30.021	Eighteenth.....	29.808	Second.....	29.900
April.....	29.945	Thirtieth.....	29.772	Twenty-third...	29.856
May.....	29.977	Twenty-third...	29.776	Tenth.....	29.874
June.....	29.917	Twenty-ninth...	29.786	Twenty-first...	29.852
July.....	29.920	Eighteenth.....	29.799	Thirtieth.....	29.856
August.....	29.927	Third.....	29.755	do.....	29.850
September.....	29.920	Twenty-ninth...	29.774	Third.....	29.844
October.....	29.924	Fourteenth.....	29.768	Seventeenth.....	29.858
November.....	29.904	Third.....	29.773	Twenty-eighth...	29.838
December.....	29.964	Twenty-second...	29.795	Fifth.....	29.865
Year.....	30.021	Mar. 18.....	29.755	Aug. 30.....	29.863

Months.	Cristobal.				
	Maximum.	Date.	Minimum.	Date.	Monthly mean.
January.....	29.947	Twenty-sixth...	29.828	Eighteenth.....	29.887
February.....	30.023	Fourteenth.....	29.803	Twenty-eighth...	29.897
March.....	30.026	Eighteenth.....	29.823	Third.....	29.910
April.....	29.947	Ninth.....	29.782	Sixteenth.....	29.866
May.....	29.967	Twenty-second...	29.787	Tenth.....	29.878
June.....	29.916	Twenty-ninth...	29.799	Twentieth.....	29.853
July.....	29.933	Eighteenth.....	29.805	Twenty-sixth...	29.861
August.....	29.936	Third.....	29.762	Thirtieth.....	29.856
September.....	29.918	Twentieth.....	29.785	Third.....	29.846
October.....	29.929	Twenty-ninth...	29.750	Seventeenth.....	29.856
November.....	29.910	Third.....	29.778	Thirteenth.....	29.844
December.....	29.963	Twenty-second...	29.800	Fifth.....	29.877
Year.....	30.026	Mar. 18.....	29.750	Oct. 17.....	29.869

TABLE 7.—Wind direction and velocity, Canal Zone, year 1910.

Months.	Ancon.				Culebra.				Cristobal.			
	Average hourly movement.	Pre-vailing direction.	Maximum velocity.		Average hourly movement.	Pre-vailing direction.	Maximum velocity.		Average hourly movement.	Pre-vailing direction.	Maximum velocity.	
			Miles.	Date.			Miles.	Date.			Miles.	Date.
January.....	8.7	NW.	23	Twenty-first.....	8.8	NW.	30	Thirty first.....	13.6	N.	31	NW.
February.....	8.9	NW.	25	Seventh.....	10.3	NW.	33	Fourteenth.....	15.3	NE.	36	NE.
March.....	8.9	NW.	27	Fourth.....	9.8	NW.	31	Third.....	13.9	N.	33	NW.
April.....	8.1	NW.	24	Ninth.....	8.5	NW.	30	Twenty-third.....	13.1	N.	27	NE.
May.....	6.3	NW.	27	Twenty-eighth.....	5.8	NW.	24	Thirteenth.....	8.7	N.	24	NE.
June.....	5.7	NW.	24	Twenty-ninth.....	4.6	NW.	24	Twenty-eighth.....	6.4	SE.	19	SW.
July.....	6.4	NW.	23	Tenth.....	5.1	NW.	39	Twentieth.....	6.8	SE.	29	S.
August.....	6.1	NW.	31	Nineteenth.....	5.6	NW.	30	Eighth.....	7.2	NW.	25	W.
September.....	5.3	NW.	18	Fourteenth.....	4.5	NW.	31	Twenty-eighth.....	5.5	SE.	24	S.
October.....	7.2	S.	26	Seventeenth.....	5.3	SE.	33	Twenty-seventh.....	6.6	SE.	36	SW.
November.....	7.0	NW.	23	Sixth.....	6.6	NW.	22	Sixth.....	8.6	W.	30	W.
December.....	7.4	NW.	24	Twenty-fourth.....	7.6	NW.	24	Nineteenth.....	11.5	N.	33	N.
Year.....	7.3	NW.	31	Aug. 19.....	6.9	NW.	39	July 20.....	9.8	N.	33	N.
												Dec. 3.

NOTE.—Wind movement and maximum velocity in miles per hour.



TABLE 8.—*Evaporation in Canal Zone, January, 1907, to June, 1911, inclusive.*

Months.	1907				1908				1909				1910				1911			
	Bas Obispo.	Ancon.	Bas Obispo.	Cris-tobal.	Ancon.	Rio Grande.	Bas Obispo.	Brazos Brook.	Cris-tobal.	Ancon.	Rio Grande.	Brazos Brook.	Cris-tobal.	Ancon.	Rio Grande.	Brazos Brook.	Cris-tobal.	Ancon.	Rio Grande.	Brazos Brook.
January.....	Inches. 5,175	3,348	Inches. 5,617	4,968	Inches. 3,348	.....	Inches. 3,240	.....	Inches. 4,968	Inches. 4,364	Inches. 4,612	Inches. 4,822	Inches. 5,267	Inches. 6,024	Inches. 5,940	Inches. 6,203	Inches. 8,165	Inches. 6,024	Inches. 5,940	Inches. 6,203
February.....	5,072	6,587	5,720	7,958	3,728	.....	4,208	.....	5,353	5,350	5,528	4,868	4,574	4,530	4,912	5,115	7,104	4,530	4,912	5,115
March.....	6,538	6,997	6,290	6,557	4,931	.....	5,005	.....	6,445	6,100	6,038	5,151	6,500	6,485	7,462	6,872	9,085	6,485	7,462	6,872
April.....	6,486	5,921	5,475	6,990	3,883	.....	4,710	.....	6,467	4,379	3,996	5,025	5,209	4,163	5,138	4,939	6,990	4,163	5,138	4,939
May.....	4,681	3,219	3,175	3,570	2,451	5,960	3,517	5,366	4,597	3,378	3,916	3,904	3,463	2,949	4,015	3,200	3,200	2,949	4,015	3,200
June.....	3,125	3,046	3,415	3,194	3,417	.....	3,284	.....	3,806	2,668	2,654	3,516	2,703	2,812	3,646	.....	2,812	2,812	3,646	.....
July.....	3,152	3,017	3,425	3,822	2,080	3,117	.....	3,042	2,445	2,740	2,846	3,014	2,389	.....	.....	.....	2,389	.....	.....	.....
August.....	3,582	3,203	3,428	3,192	2,271	3,353	.....	3,760	2,636	2,968	3,006	3,189	2,791	.....	.....	.....	2,791	.....	.....	.....
September.....	3,358	3,040	3,635	3,874	2,484	3,768	.....	4,160	2,727	3,078	3,677	3,804	2,791	.....	.....	.....	2,791	.....	.....	.....
October.....	2,898	3,266	3,875	3,324	2,826	3,094	.....	4,168	3,077	3,496	3,677	3,804	2,791	.....	.....	.....	2,791	.....	.....	.....
November.....	3,560	2,414	2,720	3,700	2,322	2,713	.....	2,152	1,950	3,132	3,909	2,718	2,817	.....	.....	.....	2,817	.....	.....	.....
December.....	4,866	2,942	3,445	4,056	3,020	2,963	.....	2,379	2,746	3,528	3,442	2,746	3,732	.....	.....	.....	3,732	.....	.....	.....
Total.....	52,602	46,960	50,061	52,488	35,270	.....	.....	.....	45,030	45,007	46,327	47,834	45,630	.....	.....	.....	45,630	.....	.....	.....

NOTE.—Concrete tank 124 feet in diameter at Bas Obispo; insulated tanks 10 inches in diameter at Ancon and Cristobal; pans 4 feet in diameter floating in reservoir at Rio Grande and Brazos Brook.

TABLE 9.—*Fogs along the canal prism, year 1910.*

Months.	Ancon.			Pedro Miguel.			Culebra.			Bas Obispo.			Bohio.			Gatun.			Cristobal.		
	Number	Dura- tion.	Mean time com- menced.	Number	Dura- tion.	Mean time com- menced.	Number	Dura- tion.	Mean time com- menced.	Number	Dura- tion.	Mean time com- menced.	Number	Dura- tion.	Mean time com- menced.	Number	Dura- tion.	Mean time com- menced.	Number	Dura- tion.	Mean time com- menced.
January	1	H. m.	3.30 a. m.				7	H. m.	1.33 a. m.	9	H. m.	1.43 a. m.	13	H. m.	2.43 a. m.	7	H. m.	3.13 a. m.			
February		5 00					5	12 00	4.16 a. m.	4	11 30	4.30 a. m.	4	15 00	2.38 a. m.	1	17 45	2.30 a. m.			
March				2	3 15	4.30 a. m.	9	19 15	3.16 a. m.	8	38 30	2.30 a. m.	5	20 10	3.18 a. m.	3	4 00	Midnight			
April				4	7 05	3.10 a. m.	10	25 35	2.53 a. m.	13	56 10	1.34 a. m.	9	23 50	4.00 a. m.	3	21 30	2.41 a. m.	2	7 55	3.27 a. m.
May				8	24 15	3.49 a. m.	23	109 35	2.35 a. m.	29	117 15	1.48 a. m.	19	69 25	3.19 a. m.	4	10 35	2.10 a. m.	2	6 45	3.22 a. m.
June				11	30 25	3.44 a. m.	17	107 00	12.37 a. m.	24	132 25	12.41 a. m.	26	141 20	12.59 a. m.	11	28 58	3.10 a. m.			
July				25	148 00	1.10 a. m.	10	45 30	1.45 a. m.	24	104 20	2.20 a. m.	24	162 30	12.45 a. m.	11	51 20	2.33 a. m.			
August				9	33 35	3.17 a. m.	25	123 45	11.47 p. m.	23	93 05	2.02 a. m.	24	171 05	11.53 p. m.	11	32 39	2.11 a. m.	1	7 00	3.30 a. m.
September				8	16 10	4.28 a. m.	23	160 40	10.35 p. m.	26	133 25	1.34 a. m.	24	151 35	1.08 a. m.	19	51 35	2.05 a. m.			
October				1	7 00	3.30 a. m.	22	159 50	10.43 p. m.	26	137 00	12.20 a. m.	20	115 00	12.15 a. m.	15	51 45	2.16 a. m.			
November				25	119 45	1.36 a. m.	15	91 45	1.04 a. m.	16	59 05	2.36 a. m.	20	115 00	12.15 a. m.	10	25 45	2.16 a. m.	1	3 30	4.00 a. m.
December				15	59 55	1.19 a. m.	19	118 45	12.24 a. m.	13	43 00	3.03 a. m.	25	153 00	11.35 p. m.	8	26 50	2.07 a. m.			
Total	8	21 00		197	471 25		197	1,108 20		201	893 25		217	1,210 30		103	324 07		6	25 10	
Mean.		2 38			3 38			5 37			4 27			5 35			3 09			4 12	

*Percentage of fog dissipated.*

	Ancon.	Pedro Miguel.	Culebra.	Bas Obispo.	Bohio.	Gatun.	Cristobal.
Before 6.30 a. m.	50	67	41	56	45	85	17
Before 7.30 a. m.	100	98	75	90	88	99	83
Before 8.30 a. m.	100	100	98	95	100	100	100

TABLE 10.—*Sea temperatures, 1910.*

Months.	Atlantic Ocean (Cristobal).					Pacific Ocean (Balboa).				
	Maximum.		Minimum.		Monthly mean, °F.	Maximum.		Minimum.		Monthly mean, °F.
	° F.	Date.	° F.	Date.		° F.	Date.	° F.	Date.	
January..	80	Sixth <sup>1</sup>	75	First.....	78.1	82	Sixth <sup>1</sup> .....	67	Thirtieth <sup>1</sup> ....	77.8
February..	82	Eighteenth <sup>1</sup>	76	Fifth.....	79.3	79	Twenty-eighth	60	Ninth.....	71.0
March.....	83	Twelfth <sup>1</sup>	78	Seventh <sup>1</sup> .....	80.3	77	First.....	66	Twenty-fifth <sup>1</sup>	70.1
April.....	85	Twenty-third <sup>1</sup>	80	First <sup>1</sup> .....	81.8	82	Seventeenth <sup>1</sup>	68	Seventh.....	77.0
May.....	85	Thirtieth.....	79	Nineteenth <sup>1</sup>	81.3	85	Thirtieth.....	74	Second <sup>1</sup> .....	80.0
June.....	86	Eighteenth.....	80	Seventh.....	83.1	85	Third.....	79	Seventh.....	81.8
July.....	85	First <sup>1</sup> .....	80	Tenth <sup>1</sup> .....	82.4	82	First <sup>1</sup> .....	78	Sixth <sup>1</sup> .....	79.9
August.....	86	Fifteenth.....	81	First <sup>1</sup> .....	83.2	84	Thirty-first.....	79	First <sup>1</sup> .....	80.3
September.....	87	Eleventh.....	81	Sixth.....	83.6	87	Sixteenth.....	79	Fifth.....	83.2
October.....	85	Second.....	80	Twenty-fifth <sup>1</sup>	82.5	84	First <sup>1</sup> .....	79	Twentieth.....	82.1
November.....	84	Sixteenth.....	78	Sixth <sup>1</sup> .....	80.6	83	Fifteenth <sup>1</sup> ....	79	Eighth <sup>1</sup> .....	80.8
December.....	82	Seventh <sup>1</sup> .....	78	Fourth <sup>1</sup> .....	79.8	81	Ninth <sup>1</sup> .....	78	Fourth.....	80.2
Year.....	87	Sept. 11.....	75	Jan. 1.....	81.3	87	Sept. 16.....	60	Feb. 9.....	78.7

<sup>1</sup> Other dates also.TABLE 11.—*Tidal conditions, 1910.*

[Elevations are referred to mean sea level.]

Months.	Atlantic coast (Cristobal).							
	Maximum high water.		Extreme low water.		Amplitude.			
					Maximum.		Minimum. <sup>1</sup>	
	Elevation.	Date.	Elevation.	Date.	Elevation.	Date.	Elevation.	Date.
January.....	+1.31	Twenty-second.	−0.67	Ninth.....	1.74	Twelfth.....	0.20	Twenty-fourth.
February....	+1.12	Ninth.....	−.57	Twenty-first...	1.58	Nineteenth....	.20	Twenty-second.
March.....	+ .97	Seventeenth.....	− .61	Nineteenth.....	1.56	.....do.....	.19	Twenty-third.
April.....	+1.17	Fourteenth.....	− .63	Twenty-eighth	1.71	Fourteenth <sup>2</sup> ..	.20	Third.
May.....	+1.38	Ninth.....	−1.00	.....do.....	1.94	Eleventh.....	.20	First. <sup>3</sup>
June.....	+1.10	Eighth.....	−1.01	Ninth.....	1.95	Ninth.....	.22	Twenty-seventh.
July.....	+1.31	Fourth.....	−.71	Sixth.....	1.88	Fifth.....	.25	Fourth.
August.....	+1.29	First.....	−.66	Thirtieth.....	1.80	Fourth.....	.20	Fourteenth.
September..	+1.19	Twenty-fourth	−.67	First.....	1.62	Twenty-sixth.	.21	Second.
October.....	+1.09	Twelfth <sup>2</sup> .....	−.71	Twenty-fifth...	1.73	Twenty-third.	.20	Ninth. <sup>2</sup>
November...	+1.25	Eighteenth.....	−.79	Nineteenth.....	1.87	Eighteenth....	.25	Sixteenth.
December....	+1.44	Sixteenth.....	−.75	Thirtieth.....	2.01	Seventeenth...	.22	Sixteenth. <sup>3</sup>
Year....	+1.44	Dec. 16.....	−1.01	June 9.....	2.01	Dec. 17.....	.19	Mar. 23.

<sup>1</sup> One tidal fluctuation is often entirely absent on the Atlantic coast.<sup>2</sup> Other dates also.

TABLE 11.—*Tidal conditions, 1910—Continued.*

[Elevations are referred to mean sea level.]

Months.	Pacific coast (Balboa).							
	Maximum high water.		Extreme low water.		Amplitude.			
					Maximum.		Minimum.	
	Elevation.	Date.	Elevation.	Date.	Elevation.	Date.	Elevation.	Date.
January.....	+ 8.5	Fifteenth.....	- 8.8	T w e n t y - seventh.	16.2	Fourteenth....	6.6	Fifth.
February....	+ 9.0	Twelfth.....	- 9.6	Twelfth.....	18.6	Twelfth.....	5.9	Fourth.
March.....	+10.1	Fourteenth....	- 9.8	Thirteenth....	19.8	Thirteenth <sup>1</sup> ...	5.6	Sixth.
April.....	+10.2	Eleventh.....	-10.6	Eleventh.....	20.8	Eleventh.....	5.9	Fourth.
May.....	+10.1	Tenth.....	-10.1	Ninth.....	20.1	Tenth.....	7.2	Third.
June.....	+ 9.3	Eighth.....	- 9.1	Eighth.....	18.4	Eighth.....	7.8	Seventeenth. <sup>1</sup>
July.....	+ 9.0	Seventh <sup>1</sup> .....	- 8.0	Seventh.....	17.0	Seventh.....	6.8	Seventeenth.
August.....	+ 9.4	Twenty-fourth	- 8.1	Sixth.....	17.4	Twenty-fourth	6.0	Fifteenth.
September...	+10.2	Twenty-second.	- 8.8	Twenty-first..	18.9	Twenty-first <sup>1</sup> ..	5.3	Fourteenth.
October.....	+11.0	Twentieth.....	- 9.6	Twentieth....	20.6	Twentieth....	5.9	Thirteenth.
November....	+10.4	Eighteenth....	- 9.6	Eighteenth....	20.0	Eighteenth....	6.7	Eleventh.
December....	+ 9.3	Seventeenth....	- 9.4	.....do.....	18.6	.....do.....	7.8	Twenty-fifth. <sup>1</sup>
Year...	+11.0	Oct. 20.....	-10.6	Apr. 11.....	20.8	Apr. 11.....	5.3	Sept. 14.

<sup>1</sup> Other dates also.

TABLE 12.—*Seismic disturbances recorded at Ancon, Canal Zone, year ended June 30, 1911.*

[Latitude, 8° 57' N.; longitude, 79° 32' W.]

100-K.—BOSCH-OMORI SEISMOGRAPHS.

Greenwich mean time.

Dates.	Component.	Preliminary tremors commence.	Second group commence.	Long waves commence.	Maximum.	End.	Maximum amplitude.
1910.							Mm.
July 10.....	N.-S.	15.04		15.08	15.09	15.30	2.5
	E.-W.	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
17.....	N.-S.	14.47		14.47	14.47	14.50	15.0
	E.-W.	14.47		14.47	14.47	14.50	6.0
Aug. 3.....	N.-S.	22.50		22.52	22.52	23.03	1.0
	E.-W.	22.50		22.52	22.52	22.58	0.5
11.....	N.-S.	16.33		16.37	16.39	17.07	2.5
	E.-W.	16.33		16.37	16.39	17.00	2.0
Sept. 8.....	N.-S.	19.25		19.25	19.26	19.38	7.5
	E.-W.	19.25		19.25	19.25	19.28	6.0
24.....	N.-S.	3.37		3.40	3.40	4.15	1.5
	E.-W.	3.37		3.40	3.40	4.15	1.0
24.....	N.-S.	( <sup>2</sup> )	( <sup>2</sup> )	18.41	18.42	19.04	35.0
	E.-W.	( <sup>2</sup> )	( <sup>2</sup> )	18.41	18.42	19.04	42.5
Oct. 4.....	N.-S.	23.07		23.12	23.18	23.36	3.5
	E.-W.	23.07		23.12	23.18	23.36	2.5
Nov. 28.....	N.-S.	2.00		2.10	2.11	2.31	2.5
	E.-W.	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Dec. 20.....	N.-S.	23.09		23.10	23.10	23.31	47.0
	E.-W.	23.09		23.10	23.10	23.28	55.0
21 <sup>3</sup> .....	N.-S.	10.25		10.26	( <sup>7</sup> )	( <sup>7</sup> )	43.5
	E.-W.	10.25		10.26	10.26	( <sup>7</sup> )	75.0
21.....	N.-S.	21.06		21.06	21.06	21.15	3.5
	E.-W.	21.05		21.06	21.06	21.15	5.0
1911.							
Jan. 3-4.....	N.-S.	(3) 23.47	(4) 0.05	(4) 0.25	(4) 0.35	(4) 1.36	1.2
	E.-W.	(3) 23.47	(4) 0.05	(4) 0.25	(4) 0.35	(4) 1.12	1.0
7.....	N.-S.	13.31		13.31	13.31	13.34	3.0
	E.-W.	13.31		13.31	13.31	13.35	1.5
Feb. 15.....	N.-S.	23.51		23.52	23.52	23.58	3.5
	E.-W.	23.51		23.52	23.52	23.58	2.5
Apr. 10 <sup>4</sup> .....	N.-S.	18.42		18.43	18.43	( <sup>7</sup> )	45.0
	E.-W.	18.42		18.43	18.43	19.06	55.0
25.....	N.-S.	23.27		23.27	23.27	23.33	1.5
	E.-W.	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
28.....	N.-S.	9.56		9.59	10.00	10.12	4.0
	E.-W.	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
May 4-5.....	N.-S.	23.56	( <sup>7</sup> )	( <sup>7</sup> )	(5) 0.11	( <sup>7</sup> )	0.2
	E.-W.	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
12.....	N.-S.	2.28		2.29	2.30	2.42	1.0
	E.-W.	2.28		2.29	2.30	2.40	1.5
17.....	N.-S.	12.33		12.35	12.35	12.50	3.0
	E.-W.	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
June 2.....	N.-S.	11.58		11.59	11.59	12.09	7.5
	E.-W.	11.58		11.59	11.59	12.06	3.5
5.....	N.-S.	( <sup>7</sup> )	( <sup>7</sup> )	4.13	4.17	4.22	0.2
	E.-W.	( <sup>7</sup> )	( <sup>7</sup> )	4.11	4.16	4.22	0.1
7 <sup>5</sup> .....	N.-S.	11.06	11.08	11.12	11.09	13.02	3.0
	E.-W.	11.04	11.08	11.12	11.09	12.09	7.5
15.....	N.-S.	14.45	14.48	14.49	14.49	16.15	6.0
	E.-W.	14.45	14.48	14.49	14.49	16.11	6.0
20.....	N.-S.	1.31	1.33	1.34	1.34	1.43	0.8
	E.-W.	1.31	1.33	1.34	1.34	1.42	1.0
22.....	N.-S.	( <sup>7</sup> )	( <sup>7</sup> )	0.42	0.44	0.52	0.5
	E.-W.	( <sup>7</sup> )	( <sup>7</sup> )	0.43	0.44	0.48	0.3

<sup>1</sup> Instrument not in operation.<sup>2</sup> Absent.<sup>3</sup> Pen passed off sheet; record incomplete. This shock sensibly felt at number of stations in the Canal Zone.<sup>4</sup> Pen passed off sheet; record incomplete.<sup>5</sup> Destructive quake in Mexico.

NOTE.—Period of pendulum, 25 seconds. Magnification of N.-S. and E.-W. components changed from 13 and 12.5, respectively, to 10 on June 19, 1911. Damping, medium. The amplitude indicates half of the complete range of maximum motion. (In previous reports the amplitude indicated the complete range of maximum motion).

TABLE 13.—*Seismic disturbances recorded at Ancon, Canal Zone.*

[Latitude, 8° 57' N.; longitude, 79° 32' W.; year ended June 30, 1911.]

25-K.—BOSCH-OMORI SEISMOGRAPHS.

Greenwich mean time.

Dates.	Com- ponent.	Prelimi- nary tremors com- mence.	Second group com- mence.	Long waves com- mence.	Maxi- mum.	End.	Maxi- mum ampli- tude.
1910.							
July 10.....	N.-S.	15.05	.....	15.08	15.09	15.30	<i>Mm.</i> 5.0
	E.-W.	15.05	.....	15.08	15.08	15.21	1.0
17.....	N.-S.	14.47	.....	14.47	14.47	14.50	1.5
	E.-W.	14.47	.....	14.47	14.47	14.50	1.5
Aug. 3.....	N.-S.	22.50	.....	22.52	22.52	22.58	0.5
	E.-W.	22.50	.....	22.53	22.53	22.58	0.3
11.....	N.-S.	16.33	.....	16.37	16.39	17.07	1.5
	E.-W.	16.33	.....	16.37	16.38	16.68	1.5
Sept. 8.....	N.-S.	19.25	.....	19.25	19.25	19.29	1.2
	E.-W.	19.25	.....	19.25	19.25	19.28	1.2
24.....	N.-S.	3.37	.....	3.40	3.44	4.15	1.0
	E.-W.	3.37	.....	3.40	3.45	4.15	1.0
24.....	N.-S.	( <sup>1</sup> )	( <sup>1</sup> )	18.41	18.42	19.03	11.0
	E.-W.	( <sup>1</sup> )	( <sup>1</sup> )	18.41	18.42	19.02	11.0
Oct. 4.....	N.-S.	23.07	.....	23.12	23.18	(5) 0.40	1.0
	E.-W.	23.07	.....	23.12	23.18	23.30	2.0
Nov. 28.....	N.-S.	2.09	.....	2.10	2.11	2.33	2.0
	E.-W.	2.09	.....	2.10	2.11	2.29	4.5
Dec. 20.....	N.-S.	23.09	.....	23.10	23.10	23.32	11.0
	E.-W.	23.09	.....	23.10	23.10	23.30	41.5
21 <sup>2</sup> .....	N.-S.	10.25	.....	10.26	10.26	11.03	43.0
	E.-W.	10.25	.....	10.26	10.26	10.68	52.5
21.....	N.-S.	21.05	.....	21.06	21.06	21.15	1.5
	E.-W.	21.05	.....	21.06	21.06	21.15	5.5
1911.							
Jan. 3-4.....	N.-S.	(2) 23.47 <sup>3</sup>	(4) 0.05	(4) 0.25	(4) 0.35	(4) 1.50	10.0
	E.-W.	(3) 23.47	(7)	(4) 0.25	(4) 0.31	(4) 1.34	0.2
7.....	N.-S.	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )
7.....	N.-S.	13.34	.....	13.31	13.31	13.34	0.8
	E.-W.	13.31	.....	13.31	13.31	13.34	1.0
Feb. 15.....	N.-S.	23.51	.....	23.52	23.52	23.58	1.0
	E.-W.	23.51	.....	23.52	23.52	23.58	1.5

<sup>1</sup> Absent.<sup>2</sup> Pen passed off sheet, record incomplete.<sup>3</sup> N-S 25-k. instrument undamped.<sup>4</sup> Destructive quake in Russian Turkestan.

NOTE.—Instruments dismantled in March, 1911, preparatory to moving to Gatun, Canal Zone. Period of pendulum, 25 seconds; magnification, 12; damping, medium. The amplitude indicates half of the complete range of maximum motion. (In previous reports the amplitude indicated the complete range of maximum motion.)

## HYDROGRAPHY.

## STATIONS AND EQUIPMENT.

Gauging stations have been maintained during the year on the Chagres River at Gatun, Gamboa, and Alhajuela. Or account of the backwater from Gatun Lake, the gauging station on the Trinidad at Lagartera was removed to a point just below the junction of the Siri and the Trinidad. For the same reason the gauging station at Bohio was abandoned September 1, 1910, so far as regular gaugings are concerned, being now used only in case of freshets. Automatic water-stage registers are now in operation above and below the spillway at Gatun, and on the Chagres River at Bohio, Gamboa, Alhajuela, and Vigia; on the Rio Grande River above the reservoir and on the Pedro Miguel and Trinidad Rivers at elevations that will be about lake level when the canal is finished.

The meter rating station at Bohio has been continued in operation and all meters used on the work have been rated and adjusted at stated intervals.

## GAUGINGS.

The regular field work has been carried on as usual by the hydrographers and observers at the different stations. At Alhajuela this work has consisted of current meter gaugings and the keeping of constant records of river height. The gaugings have been made frequently and at as many different elevations as possible, with the result that, despite the tendency of the river bed to shift, the discharge curves for the several months have accurately indicated the quantity of water passing at the various river heights. The hydrographer at this station has had charge of gaugings on the upper and lower tributaries, including the Pequeni, Chagres (proper), La Puente, Gatuncillo, Chilibre, and the Aguardiente, these measurements being made weekly when possible.

Discharge measurements were begun at Gamboa in November, 1910, after the completion of the gauging station, and have been continued since. During the dry season, as the river was unusually low, gaugings were made by boat. According to past records the elevation of the river at Gamboa has never been as low as it was during the dry season of 1911, although the discharge at this point has been less on many occasions. It is believed that this unusual condition is due to changes in the river bed caused by gravel excavation work of the Panama Railroad just above the fluvigraph. The gaugings at this station were made by a hydrographer from the central office, and river-height records have been continued throughout the year. A series of measurements was made in the gravel bar near the gauging station to obtain the slope of the ground water from which to estimate the amount of water flowing through the gravel in the bed of the stream. This experiment, although rough, indicated that the quantity thus passing was extremely small in comparison with the surface flow of the river.

Although abandoned as a regular gauging station, measurements of the cross section at Bohio have been taken from time to time in order that gaugings could be made if necessary in time of flood or discharge estimates could be estimated from the gauge heights. Constant records of the river heights also have been kept. At Gatun the entire run-off from the Chagres basin has passed through the spillway since April, 1910, and gaugings have been regularly made. Up to the dry season of 1911 gaugings were made from a boat, a section above the spillway entrance being used during June and July, and a section just below the spillway after that time. During the period of very low water it was possible, by wading, to work in the spillway itself, and some very good measurements of the absolute minimum flow were obtained. At the same time comparative gaugings were made at the cable station below the spillway which showed that, with the channel in proper condition, gaugings at the latter place would be satisfactory. Continuous records of the height of the lake have been kept throughout the year and of the water below the spillway since February 1, 1911.

As mentioned above, backwater from Gatun Lake has interfered with gauging work at Lagartera on the Trinidad and construction work on the relocated line of the Panama Railroad has interfered with the work on the Gatun River at Monte Lirio. The former stream and its tributaries have been gauged on an average of twice a month, so that some figures of flow are available, and those taken in the dry

season are especially valuable. On the Gatun River gaugings have been made intermittently; the one at the end of the dry season being of greatest value as giving the probable minimum flow for the year. A water-stage register was maintained at this station until the cut-off was made and after that time reports of lake height were made twice each day.

River heights have been reported from regular river stations three times a day, from San Pablo and Tabernilla twice a day, and from Gorgona and Frijoles as was required in times of exceptional rises. Besides the gaugings at the regular stations, the following streams in the Canal Zone have been gauged:

Streams.	Monthly discharge in cubic feet per second.	
	Maximum.	Minimum.
Chagra (upper).....	2,750.0	475.00
Pequeñ.....	1,860.0	258.00
Chilibre.....	290.0	1.00
Gatuncillo.....	167.0	3.00
La Fuente.....	157.0	12.00
Frijolito.....	23.0	6.00
Frijoles.....	22.0	4.00
Catmito.....	15.0	.11
Cardenas.....	6.3	.16
Frijoles Grande.....	3.0	.40
Pedro Miguel.....	110.0	.50
Coccol (main stream 1 mile above spillway).....	4.3	.45

#### FRESHETS.

Vigia, Alhajuela, and Gamboa have been used as warning stations in times of freshets, reports being sent to the central office as soon as the gauges showed signs of a rise in the river. With these data at hand, predictions of the river heights at the lower stations were made and warnings sent to the various divisions interested. In making these predictions a percentage of the Vigia rise was used to obtain the proper rise at Gamboa. The figure used during the first part of the year was 0.9 of the Vigia rise to give the probable rise at Gamboa, and this ratio held fairly closely, unless the freshets were large enough to overtop the old Santa Cruz dike below the Gamboa bridge, in which case the increased area of outflow gave the water a chance to run off faster, with the result that the maximum heights were proportionately lower than for the smaller rises. In the largest freshet of the year—December 3—the ratio of Gamboa to Vigia rise was 0.645, and in the large dry-season freshet—February 12, 1911—the ratio was 0.666. The average of all rises exceeding 5 feet at Vigia for the river year ended April 30, 1911, was 0.749. For predicting river heights at Bohio and Gatun no rules which formerly applied could be used during the past year. To obtain some data with which to work, all rises which occurred, whether great or small, were tabulated with the rainfall which possibly caused them. By comparison with these figures estimates were made for each new rise and warnings given accordingly. The average ratios for the year ended April 30, 1911, were: Bohio–Gamboa, 0.378; Gatun–Gamboa, 0.150; Gatun–Bohio, 0.370.

For obtaining discharges at the time of these freshets special work was sometimes necessary. At Alhajuela many of the rises pass at night and gaugings are often made from the car by the aid of lanterns.



During the largest freshet—December, 1910—the crest passed during daylight and 11 successful gaugings were made. At Gamboa some night work has been done, but it was not generally as necessary as at the upper station. Gaugings of the December flood were made at Bohio, although this station had been previously abandoned for regular work. At Gatun the worst conditions had to be contended with so far as gaugings were concerned. A log jam which formed above the south toe trestle so interfered with the flow at the gauging station as to make boat work impossible. Some float measurements were made at this station, but with varying success, those made in the spillway itself giving the best results. Driftwood from the jam above was timed over a course of 300 feet and the average of a number of these taken as the mean velocity, from which, with the known cross section of flow, the discharge could be computed.

*Four largest freshets of the fiscal year.*

Dates of beginning.	Vigia.		Alhajuela.			
	Elevation of crest.	Rise.	Elevation of crest.	Rise.	Hours after Vigia.	Maximum discharge.
Aug. 20, 1910.....	144.2	16.5	104.8	10.4	1	29,940
Dec. 3, 1910.....	150.9	19.7	108.7	12.2	1½	60,300
Feb. 12, 1911.....	145.5	19.3	105.5	13.8	1	43,600
June 22, 1911.....	142.0	15.2	103.6	10.4	1	40,100

Dates of beginning.	Gamboa.					
	Elevation of crest.	Rise.	Hours after Vigia.	Per cent of Vigia.	Per cent of Alhajuela.	Maximum discharge.
Aug. 20, 1910.....	60.4	12.4	7	75.2	119.2	.....
Dec. 3, 1910.....	64.5	12.7	7	64.5	104.1	57,200
Feb. 12, 1911.....	58.4	12.8	5½	67.0	93.6	34,800
June 22, 1911.....	57.1	10.8	5	71.1	104.0	30,000

Dates of beginning.	Bohio.					
	Elevation of crest.	Rise.	Hours after Gamboa.	Per cent of Gamboa.	Per cent of Alhajuela.	Maximum discharge.
Aug. 20, 1910.....	24.1	6.8	7	54.8	65.4	32,805
Dec. 3, 1910.....	30.2	7.9	11	62.2	64.7	45,000
Feb. 12, 1911.....	21.1	8.0	7½	62.0	58.0	37,500
June 22, 1911.....	20.7	5.3	7½	49.1	51.0	.....

Dates of beginning.	Gatun.					
	Elevation of crest.	Rise.	Hours after Gamboa.	Per cent of Gamboa.	Per cent of Bohio.	Maximum discharge.
Aug. 20, 1910.....	19.5	2.5	17	20.2	36.8	19,900
Dec. 3, 1910.....	26.1	5.0	37	39.8	63.9	52,650
Feb. 12, 1911.....	15.7	2.6	11½	20.0	32.6	6,240
June 22, 1911.....	17.6	2.3	28½	21.3	43.4	9,830

<sup>1</sup> Estimated.

## MISCELLANEOUS.

Reconnaissance surveys have been made of the La Puente, Chilibrillo, Maria Prieta, Chilibre, Cabulla, and Pedro Miguel Rivers, and a rough survey was made of a limestone cavern on the Chilibrillo branch above the elevation of the proposed lake, and the results are on file for reference. Values of coefficients of flow have been investigated at Gamboa and Gatun spillway.

For estimating the flow of water through the gravel of the river bed at Gamboa sand analyses were made and reported on. Studies of the comparative yields of the different streams gauged during the dry season of 1911 have been receiving special attention and the results obtained are tabulated and filed for reference.

Daily hydrographic reports have been received from all stations and published with the meteorological reports. All gaugings have been computed, checked, tabulated, and filed. Monthly discharge curves have been constructed and discharge tables made. Meter ratings made at Bohio rating station have been calculated, checked, tabulated, and filed, and monthly reports of hydrographic work and conditions, including discharge estimates and hydrographic conditions, have been submitted. In the way of special work attention has been given to studies of the relation between rainfall and run-off over the whole Chagres Basin for a long period and on the Rio Grande for periods of excessive rainfall and run-off and the results tabulated and filed for reference.

The following plates accompany the report of this section:

PLATE 72.—Gaging station, Gatun (photograph).

PLATE 123.—Mass curve, Gatun.

PLATE 124.—Discharge duration curves, Gatun.

PLATE 125.—Discharge duration curves, Alhajuela.

PLATE 126.—Surface slope of Chagres, freshet of February, 1911.

The following tables, accompanying the report of this section, are appended:

TABLE 14.—Discharge from Chagres River drainage basin, year 1910.

TABLE 15.—Discharge measurements from actual gaugings.

TABLE 16.—Monthly discharge at Gatun.

TABLE 17.—Freshets at Gamboa, 1890 to June, 1911, inclusive.

TABLE 14.—Discharge from Chagres River drainage basin for year 1910.

[Rate in cubic feet per second.]

Months.	Station.				
	Alhajuela.			Gatun.	
	Monthly mean.	Absolute.		Monthly mean.	Absolute.
		Maximum.	Minimum.		Maximum. Minimum.
January.....	5,050	34,400	2,200	11,740	50,300 4,800
February.....	2,870	31,000	1,700	5,080	23,400 2,600
March.....	1,025	19,400	1,090	3,160	18,000 1,800
April.....	3,140	21,800	1,520	4,560	11,650 1,890
May.....	5,220	39,000	1,750	10,270	17,600 4,950
June.....	3,310	27,000	1,850	11,050	14,350 7,050
July.....	4,420	27,000	2,400	13,800	17,940 10,660
August.....	4,400	29,940	2,160	13,020	22,100 8,570
September.....	4,339	27,200	2,500	11,637	16,730 8,320
October.....	4,398	25,200	2,380	12,710	22,890 7,270
November.....	4,490	34,000	2,990	17,312	24,150 10,760
December.....	5,964	60,300	2,450	21,820	52,650 8,450
Mean.....	4,102			11,347	
Absolute.....		60,300	1,090		52,650 1,800

Drainage areas: Alhajuela, 427 square miles; Gatun, 1,320 square miles.

TABLE 15.—*Discharge measurements from actual gaugings.*

[Discharge curve not used.]

Streams.	Period.	Number of gaugings.	Maximum discharge.		Minimum discharge.		Mean discharge.
			Cubic feet per second.	Date.	Cubic feet per second.	Date.	
Trinidad.....	Year 1910.....				330	Mar. —	<sup>1</sup> 1,713
Gatun.....	do.....				<sup>1</sup> 190	do.....	<sup>1</sup> 1,117
Upper Chagres.....	River year.....	36	3,256	Dec. 17	412	Apr. 4	1,568
Pequenil.....	do.....	36	2,220	do.....	217	do.....	950
La Puente.....	October, 1910-June, 1911...	31	323	Dec. 6	11	Apr. 20	81
Gatuncillo.....	Fiscal year.....	47	479	Oct. 21	1.9	Apr. 18	112
Chillibre.....	do.....	46	524	Oct. 11	.6	Apr. 26	138
Aguardiente.....	September, 1910-June, 1911	32	184	Oct. 21	.4	Apr. 6	41

<sup>1</sup> Estimated.<sup>2</sup> Gauging Apr. 20, 1911—99 cubic feet per second.

NOTE.—Fiscal year ends June 30, 1911; river year ends Apr. 30, 1911.

TABLE 16.—*Discharge at Gatun.*

[In cubic feet per second.]

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mns.
1890.....	6,604	2,518	2,059	2,002	10,624	13,273	13,446	14,190	16,992	16,102	9,842	14,703	10,204
1891.....	4,348	2,231	972	972	8,640	5,207	7,781	7,324	7,551	11,099	18,651	12,759	7,295
1892.....	3,776	2,059	1,887	3,833	13,731	8,811	18,479	15,162	10,928	14,741	18,022	15,162	10,549
1893.....	5,722	3,776	2,346	5,550	7,552	8,009	12,357	17,450	12,416	13,903	18,538	30,037	11,471
1894.....	11,442	2,918	1,693	1,259	6,435	6,922	10,070	10,527	12,072	15,162	20,597	20,368	9,872
1895.....	7,381	2,231	1,716	1,716	6,750	6,961	7,437	11,214	9,383	11,214	9,842	11,270	7,261
1896.....	7,606	2,518	1,430	2,745	8,009	6,809	5,092	5,664	9,612	10,293	12,301	9,783	6,827
1897.....	3,318	2,674	1,144	1,430	12,931	6,809	8,296	11,786	11,157	12,129	11,271	11,042	7,824
1898.....	9,155	2,746	1,774	3,261	4,348	5,435	10,642	8,583	8,207	8,181	12,701	4,635	6,399
1899.....	6,237	2,804	1,602	1,774	3,318	5,062	6,409	9,268	6,806	8,009	8,580	5,836	5,483
1900.....	3,433	1,716	1,202	1,144	2,632	4,635	9,096	8,524	7,724	11,329	10,700	6,065	5,653
1901.....	2,402	1,602	1,144	913	3,720	4,520	5,148	6,981	9,383	10,242	21,455	7,437	6,246
1902.....	18,194	3,376	2,059	3,490	4,318	5,148	4,920	5,492	6,350	9,612	10,814	4,865	6,553
1903.....	2,632	1,659	1,030	915	2,461	4,120	6,522	8,868	9,211	9,034	13,503	16,992	6,412
1904.....	8,009	3,776	2,299	5,894	4,910	7,652	7,306	5,139	10,792	7,938	12,334	6,681	6,894
1905.....	3,140	1,599	1,142	970	4,568	4,253	3,083	6,283	6,395	11,250	7,652	4,624	4,582
1906.....	2,164	1,397	988	1,020	3,479	4,321	8,472	10,277	8,824	6,594	12,664	17,237	6,501
1907.....	5,399	2,257	1,620	1,090	2,997	5,915	7,135	5,941	8,999	13,479	9,299	5,602	5,811
1908.....	1,976	1,046	851	892	5,046	5,025	5,744	8,896	8,708	8,859	14,408	8,017	5,788
1909.....	6,505	5,280	2,150	2,215	4,215	9,890	9,920	10,960	9,910	12,590	28,470	25,800	10,658
1910.....	11,740	5,080	3,160	6,090	10,270	11,060	13,800	13,020	11,637	12,710	17,312	21,820	11,472
Means.	6,254	2,626	1,631	2,357	6,188	6,602	8,627	9,598	9,529	11,165	14,236	12,416	7,606

NOTE.—From 1890 to May, 1908, discharge estimated from present relations; May, 1908, to January, 1911, from current meter measurements.

TABLE 17.—*Freshets at Gamboa, 1890 to June, 1911, attaining elevation 56 or over, and absolute maxima of the periods.*

Year.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total.	
	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.	Number.	Maximum elevation.
1890																										
1891																										
1892																										
1893																										
1894	2	63.9	1	63.4	2	62.3	1	62.4	3	62.4	1	61.9	4	60.8	3	62.1	3	62.1	5	63.4	3	62.1	3	62.1	34	77.8
1895	1	56.3			1	56.0	1	56.0	2	62.4	1	61.9	4	60.8	2	59.9	3	59.9	3	58.5	2	60.1	6	59.1	24	68.8
1896																										
1897																										
1898	2	63.0			1	56.2	6	56.0	2	62.4	1	61.9	1	58.6	2	56.3	2	56.3	2	56.2	3	58.7	4	59.2	11	69.0
1899	2	60.2			1	63.7	2	56.5	1	56.1	1	56.1	2	57.6	2	59.5	1	57.2	3	61.1	2	60.8			10	62.2
1900																										
1901																										
1902	3	62.4			1	57.2	1	59.4	1	56.1	1	56.1	1	56.1	2	56.3	1	57.7	2	62.4	3	57.8	1	61.4	13	66.9
1903																										
1904	1	60.0			2	57.5			2	58.7	1	61.4	1	56.6	1	62.1	3	58.8	2	62.4	3	57.8	6	59.0	12	66.3
1905																										
1906																										
1907																										
1908																										
1909	3	56.7	1	64.9																						
1910	1	57.2	1	56.7																						
1911																										
Total.....	15		3		8		36		21		35		36		16		31		51		48		298			
Maxima.....		63.9		64.9		63.7		66.0		67.4		67.4		64.7		62.2		62.1		63.4		72.6		81.7		81.7

1 Yearly maxima.

## GENERAL SURVEYS.

## TRIANGULATION SURVEY.

During the year the observations at the primary stations begun in the previous year were completed, 15 additional stations being occupied. Notebooks and abstracts of horizontal angles were checked as received from the field. Local adjustments of the horizontal angles were made whenever necessary, and lists of directions were then prepared. For list of primary positions see Table 18.

The base line at Tabernilla was staked and measured, the total length reduced to sea level being 3,785.454 meters, with a probable error of 1:700,000. This base is located for the greater part of its length on the Tabernilla dump, the ends being on high ground north and south of the dump. Several swampy places were crossed by means of long stakes, and platforms on which to rest the tape stretchers were built where necessary. In a few cases trenches had to be dug through high places. By taking these precautions, it was possible to make tape measurements with all three points of support in a straight line in both grade and alignment. All points were exactly on line between the two terminals except one, which was found to be 1.2 inches off. No appreciable error could be due, therefore, to faulty alignment, the correction in the case cited being only 0.0004 inch. The measurements were made in accordance with instructions quoted in the last annual report. Four 150-foot Invar steel tapes were used in taking the measurements. One other tape was used as a comparator, and a sixth tape was held in reserve. All these tapes had been standardized at the Bureau of Standards, Washington. Spring balances and patent tape stretchers were used in applying the tension of 15 kilograms. These balances were previously tested in a vertical position by means of test weights, and when used horizontally allowance was made for the weight of the hook. The temperature was read by means of ordinary thermometers. No corrections were applied for temperature, since the temperature was very uniform during the entire series of measurements, ranging between 73 and 90° F., and the tapes were standardized at 78°. It appeared that no appreciable error could be occasioned by neglecting this correction, inasmuch as the coefficient of expansion of the tapes is very low (only about  $\frac{1}{3}$  that of steel). Set-ups and setbacks were measured on an engineer's scale which could be read accurately to 0.01 inch. The total of these quantities was rather large, it being necessary to set forward about 50½ inches in the aggregate. Contact was made at the rear end of the tape by bringing the index mark on the tape opposite a scratch previously made on a zinc strip, the tape being maintained under approximately correct tension, and then, after tension had been perfected and precautions taken to see that the tape was hanging freely and was not twisted, a scratch was made on the zinc strip on the front and exactly opposite the zero of the tape. At each tape length two pulls were made, and, in most cases, the agreement was perfect. When, however, two measurements differed, additional pulls were made until no doubt existed as to the proper position. For purposes of measurement, and to afford an inter-comparison of tapes, the base was divided into five sections, four of approximately 3,000 feet each, and the fifth of about 450 feet.

Each section was measured twice forward and backward (two or more pulls for each measurement), using different tapes in the two measurements. Parties changed positions relative to the direction of measurement at the end of each measurement of a section, i. e., the same party always remained at the south end of the tape and vice versa. This was designed to eliminate personal equation.

The elevations of the tops of the stakes (points of support) as referred to sea level, were determined by double lines of levels from the precise level bench marks previously established across the Isthmus. By using these, the horizontal length of the base and the reduction to sea level were computed. The correction to the horizontal was accurately computed by using the cosine of the angle of inclination, this angle being found from its sine, which is the ratio of the difference in elevation between points of support to the inclined distance between them. These computations were checked by using

the approximate formula,  $Cg = \frac{h^2}{2L}$ , in which  $Cg$  is the correction to the horizontal for a tape length,  $L$  is length of the tape, and  $h$  the difference between the elevations of the two ends. The measurements were also corrected for the set-ups and setbacks, but, as mentioned above, no corrections for temperature were applied. The measurements were also corrected to standard using the standard lengths obtained from the Bureau of Standards, these agreeing closely with lengths obtained from the field comparison. Since the tapes were supported in the same way and used with the same tension in the field and in comparing them with the standard, no corrections for tension or sag were necessary.

The results of the measurements are summarized below:

*Horizontal length of base.*

Sections.	South measurement.	North measurement.	Discrepancy.	Mean.	Probable error.	
					Feet.	Proportion.
I. ....	2,971.329	2,971.373	+0.044	2,971.351	±0.0148	1:200,000
II. ....	2,999.110	2,999.130	+ .020	2,999.1245	± .0098	1:310,000
III. ....	2,998.905	2,998.907	+ .002	2,998.906	± .0007	1:4,300,000
IV. ....	3,000.161	3,000.158	- .003	3,000.1595	± .0010	1:3,000,000
V. ....	449.943	449.949	+ .006	449.946	± .0020	1:225,000
Whole base. ....	12,419.448	12,419.826	+ .078	12,419.487	± .0179	1:700,000

The largest discrepancies occurred in sections I, V, and II, in the order named. Sections I and V are very steep in places, the difference of elevation between consecutive stakes reaching as high as 60 feet. Section II is through a swampy place where observation conditions were far from favorable. The adjustment of the triangulation was made by the United States Coast and Geodetic Survey, and a special report upon the methods of computation was submitted by Mr. William Bowie, chief, Computing Division, and inspector of geodetic work, under date of January 17, 1911.

The primary scheme of the Isthmian Canal Commission extends across the Canal Zone, connecting astronomic stations previously established at Colon and Panama. The astronomic station at Colon is referred to Colon Lighthouse, and that at Panama to the southeast

spire of the cathedral. The astronomic latitudes and longitudes of these stations are given in United States Hydrographic Office Publication No. 65, pages 98 and 99. The observed azimuth of the line of triangulation Colon south base to Colon north base was used in the computation of the triangulation, and had been previously determined by the Coast Survey in 1905 in connection with the tertiary system executed by them in the vicinity of Colon. The triangulation done by the Isthmian Canal Commission was classed as secondary by the Coast Survey, having an average closing error of 1.98 seconds per triangle and a maximum closing error of a triangle of 5.12 seconds. The length depends upon the Tabernilla base line mentioned above.

The triangulation was adjusted by the method of least squares. The length of the Coast Survey base line at Colon when compared with the Tabernilla base line by means of the connecting triangles was found to have a discrepancy of only 1:46,000. The Coast Survey triangulation at Colon, which was considered as of tertiary accuracy, was readjusted to bring it into accord with the Isthmian Canal Commission's scheme, all discrepancies being thrown into the former.

After the triangulation of the Canal Zone had been adjusted, computations were made to carry the latitude and longitude from Colon Lighthouse through the triangulation to the Panama Cathedral spire. The results showed the difference in latitude and longitude to be, respectively, 21.01 seconds and 10.09 seconds more by astronomic determination than by triangulation. It was assumed that the distances, as given by the triangulation, are correct, and that the differences in latitude and longitude of the astronomic stations are subject to rather large station errors.

Corrections to the latitude and longitude of each station were made for the effect of topography and compensation (in accordance with the methods described in "The figure of the earth and isostasy from measurements in the United States," by Mr. John F. Hayford). By applying these corrections the differences in latitude and longitude between Colon and Panama are, respectively, 13.43 and 7.18 seconds greater by astronomic determination than by triangulation. It was stated in the report that the information at hand was entirely inadequate to throw any definite light upon the cause or causes of these anomalies, but they might be caused by an excess of mass under the Isthmus in the vicinity of the canal.

On account of the strength of the figures and the small discrepancies with which the circuits closed it did not seem necessary to measure additional bases at the ends of the main triangulation system for a check. The system was so laid out that a circuit through not over 15 well-proportioned triangles was all that was required in order to pass from the measured base at Tabernilla to the limits of the system and back by an independent route. Such a circuit and the resulting discrepancies are well within the requirements of the Coast and Geodetic Survey for work classed as secondary.

In getting a standard datum for the Canal Zone it was necessary to decide upon the geodetic position of some station, Balboa Hill, near Gorgona, being used on account of its central position. The latitude and longitude of this station, as computed through the triangulation from Colon Lighthouse on the one side and from Panama Cathedral on the other, were determined, and these values averaged

to give the standard latitude and longitude, after correction for the computed effects of topography and compensation.

The position of triangulation station Balboa is latitude  $9^{\circ} 04' 57.367''$  and longitude  $79^{\circ} 43' 50.313''$ , and the azimuth for the line Balboa-Salud is  $185^{\circ} 02' 39.54''$ . (See Map of Triangulation System, Pl. 127.) This position and azimuth is the standard datum of the Canal Zone and is designated as the "Panama-Colon datum." The advantage of this particular choice is that it gives positions on the Zone which, on the average, would agree most closely both with future observed latitudes and longitudes and with the data used in adjacent territory.

The positions on nearly all maps of the Canal Zone heretofore issued by the Isthmian Canal Commission and on the hydrographic charts of Limon Bay and vicinity are referred to the Colon datum—i. e., based on the astronomic determination of the position of Colon Lighthouse, the latitudes being about 13.5 seconds greater and the longitudes about 5.8 seconds greater than when reduced to the Panama-Colon datum. The positions on the hydrographic charts of Panama Harbor and vicinity are based on the astronomic position of the southeast tower of the Panama Cathedral, the latitude being about 7.5 seconds less and the longitude about 4.2 seconds less than when referred to the Panama-Colon datum.

#### ZONE LANDS SURVEY.

For the purpose of more readily connecting local surveys with the main triangulation system, and thus being able more quickly and accurately to check up work, a secondary system was established containing 42 stations additional. The secondary triangulation scheme was designed primarily to serve as a framework upon which the Zone lands survey system could be hung, and the majority of the stations were established in the vicinity of important section corners. Local triangulation and base-line traverse systems of the several construction divisions have been tied together, and also tied in to the primary system. These local systems have been classed as tertiary with respect to the main triangulation system (Panama-Colon datum). For list of secondary positions see Table 19.

In adjusting the secondary the adjusted primary work was considered to be exact, and all necessary corrections were applied to the latter. To simplify the adjustment of the secondary triangulation, it was broken into small figures—in most cases simple quadrilaterals—and adjusted piece by piece. Whenever lines or angles were common to more than one figure, they received but one set of corrections, being corrected from the figure first adjusted and then considered as exact in adjusting the other figures in which they occurred. The adjustment of the figures was made by the method of least squares, applying corrections primarily to the directions rather than to the angles themselves.

The adjustment of the entire secondary system was not completed at the close of the year, although the adjustment of all the stations in the southeastern half of the Canal Zone was finished and nearly half of that in the northwestern half of the Zone.

The elevations of about one-half of all the triangulation stations have been computed by the methods of trigonometric leveling from the vertical angles read between stations.



The original plan for the survey of the Canal Zone lands as described in the report for last year contemplated the laying out of the lands of the Canal Zone into quadrilaterals 2 kilometers (1.243 miles) on a side, referring lots and subdivisions to a system of rectangular coordinates. On account of its central position the primary station on Balboa Hill was chosen as the initial point of origin. The axes of coordinates are the true meridian through this initial point and a great circle at right angles to this meridian. The north, south, east, and west boundary lines of the quadrilaterals, called "guide lines" for the sake of brevity, are small circles parallel to the standard meridian and standard parallel, respectively.

The data required for running the guide lines in laying out the section corners necessitated a great deal of office work in the computation of the latitude and longitude of the principal section corners, the azimuths along the various guide lines, and several azimuths and distances between triangulation stations and adjacent section corners. The guide lines were run as "double-centered" transit lines, and as many principal section corners as practicable located by intersections between these double-centered lines and lines turned off from triangulation stations. For example, the standard base line east was located by starting at station Balboa (the origin) and turning off by repetition from the line Balboa-Salvador the computed angle around to the base line and establishing a point on this line upon the ground. The base line was then run by prolonging the portion of the line thus established, double centering on all hubs. Stadia distances were read for the purposes of getting topography and checking principal positions, as well as for getting the positions of intermediate section corners by interpolation.

The principal section corners were located in all cases by intersections between the base line and lines turned off at triangulation stations. Thus in getting the locations of the first section corner east of Balboa, which corner is visible from secondary triangulation station Posa, the latter station was occupied and a line, passing through the section corner, established from an azimuth computed from the triangulation. The intersection of this line and the base line as run gave an accurate location of the corner. The second, fourth, sixth, and eighth section corners were located similarly. Intermediate stations were located by interpolation, using the stadia distances. The other principal guide lines were run in the same way. The results, on the whole, seem satisfactory, viewed from the standpoint of accuracy. The topography along the guide lines was taken by aid of the hand level and notes made in regard to property lines, clearings, trails, streams, and other natural objects adjacent to the guide lines.

Little information in regard to the topography in the interior of the sections was, however, obtained by this method.

The southeastern quadrant, which includes the southeastern part of the Canal Zone and most of the territory between Las Cascadas and Panama City, was surveyed according to the method outlined above.

This work was practically completed except for the setting of the monuments at the end of the fiscal year, 197.2 miles of line being run. The remainder of the Canal Zone is being surveyed in a somewhat different manner, an azimuth-stadia survey of the principal

rivers, mountain ridges, and trails, or roads with considerable topographical detail being executed. The control for these surveys is furnished by the secondary triangulation system. This change in methods was made for substantially the following reasons: It was originally intended to lease land on the Canal Zone in rectangular lots. After the survey had been begun it was found that the areas of private lands and the public lands remaining were of very irregular outline. The topography of the Canal Zone is very broken. The streams for the most part flow between steep hillsides with swamps in the lowlands, and so leave the areas suitable for cultivation in isolated parcels. Property lines as at present established follow in most cases natural boundaries, such as streams and ridges, or are coincident with old and well-defined trails. These facts, together with the requirement that the areas to be allotted are limited in size to 50 hectares, make a rectangular system of less value than at first appeared, since it is likely that many rectangular tracts would not be desirable for purposes of rental.

On account of the rapid-growing and thick tropical vegetation the section corners also would soon be hidden and, frequently being in out-of-the-way places, would not be easily found. In many cases, on account of the topography, these monuments would not be inter-visible. For these reasons section corners are not as valuable for monuments and reference points as secondary triangulation stations, which are ordinarily located in prominent places and are therefore inter-visible and command a wide area. Inasmuch as most of the present property lines are streams, ridges, or trails, as mentioned above, surveys locating them also will materially aid in giving clearer location of property, the descriptions of which, based in many cases on old Spanish grants, are very difficult to interpret. These surveys, too, will be of great service in future allotments and property surveys, and will serve to locate rivers and trails much more accurately than would the running of the section lines alone. In connection with this work 160.3 miles of line had been run at the close of the fiscal year. There then remained about 195 miles, and it is expected that the field work of this survey will be completed by September 1.

A map of the Canal Zone on a scale of 1:40,000 [reduced in Plate to 1:80,000] showing primary and secondary triangulation systems, canal axis, base-line monuments, Zone boundary lines, and some of the more important topographic features is shown on Plate 127.

#### PROPERTY SURVEYS.

A survey of lots 1 and 2, as shown on the Harrison-Arosemena map, was begun in November, the necessary data for relocating these lots being prepared in the office. These lots have approximate areas of 26.6 and 44.3 square miles, respectively. In executing the field work, use was made of a triangulation scheme based on the United States Coast and Geodetic Survey work around Limon Bay, which had previously been tied in and adjusted to the Isthmian Canal Commission system (Panama-Colon datum). Azimuths and distances were computed from these stations to near-by points on the boundaries of the lots. The initial points for Panama Railroad lots 1, 3, and 5 and the intervening Government lots 2 and 4 are, respectively, Point A at Folks River, milepost 10, and milepost 20 along the

**Panama Railroad.** These points were relocated on the ground by the engineering department of the railroad from survey notes taken in 1898 and by means of the stationing given for the principal structures and for the mileposts, the latter being no longer extant. After these initial points had been located on the ground their geodetic positions were determined by running traverses to them from near-by triangulation stations or base-line monuments. The descriptions in the deed give the dimensions of the lots, the magnetic bearings of the sides, and the distances from milepost 10 and milepost 20 to the northeastern boundary of the lots. Point A is at the northwestern corner of lot 1 on the continental portion at the neck of land connecting with Manzanillo Island. After a study of existing plans and property descriptions the northeastern boundary of the lots was passed through Point A in such a direction that it would agree as nearly as possible with the distances from milepost 10 and milepost 20 as given in the deed. This method seemed to give conditions most in accord with recorded facts. All other sides and corners now became fixed in position from the deed distances alone, making the lots rectangular, and fixing the boundary between lot 2 and lot 3 by making it pass through milepost 10.

After computing the azimuths of the various sides and the geodetic positions of the several corners, ties were computed between triangulation stations Low, Malo, Tree, and Burn, and points on the boundary line between lots 1 and 2 to be used in surveying this line. After the surveys made in locating the lots had been platted upon a 1:20,000 map it was found that Point A fell much farther south of Folks River than shown on the Harrison-Arosemena map. After more investigation and adjustment, together with a comparison of old and new alignments of the Panama Railroad, a position was found where all conditions agreed fairly well, indicating that at some time there had been a relocation of mileposts along the railroad line and that the present positions were not as formerly laid out in 1855. On comparing the true bearings of the boundaries of the lots with the magnetic bearings given in the deed the variation of the compass was found to be about  $7^{\circ} 14'$  east, agreeing very well with the variation of  $7^{\circ} 15'$  east marked on the Panama Railroad map made in 1855. It now became necessary to partially rerun at least two of the lot lines—the northeastern part of the line between lots 1 and 2 and the line from C to the coast. The azimuths and distances from points previously located to points on these lines were computed to be used in getting starting points and in tying in, in rerunning the lines just mentioned.

The above work is given in some detail as it is an indication of the time it has been necessary to use in order to run down, relocate, and mark out on the ground much of the privately owned lands, title to which was to be found in ancient Spanish concessions, when descriptions of the most meager kind only were given, and many of the names of natural boundaries have become changed or forgotten during the years that have elapsed. Much of this time work was through swamps where the men worked for days at a time with the water up to the waist. In many cases stakes had to be driven in order to furnish a foundation for the transit. In other portions of the line wide paths (trochas) had to be cut through a thick tropical jungle where broad leaves and hanging vines continually interfered with instrument

work, especially on steep hillsides, where, in shooting across a gully, it was the tops of the trees that interfered with the sight. This condition is common in the tropical survey work, but the progress at times seems unusually slow.

In many cases this work could have been done at less cost by using rougher and more approximate methods, but the department of law has required that this work be such as could be sworn to in court and of such accuracy that an independent surveyor could go out and check it within reasonable limits of error.

A property map on a scale of 1:20,000 is being compiled to show the various surveys that have been made and are being made in connection with the location of the various holdings in the northeastern part of the Canal Zone. On this have been plotted the Panama Railroad and Government lots Nos. 1 to 5, as laid out in accordance with the method given above, and the topography of the northern part of the region. Among the other more important traverses plotted upon this map are those executed in locating the Bellavista tract, the Rio Indio tract, the Rio Mindi tract, the River Arenal, the coast line near Toro Point, the Inkerman and Stevenson tracts near Mount Hope, and the tract along the east diversion from Folks River to Mindi.

Another property survey of a large area not mapped on the 1:20,000 map mentioned above is that made in locating the "Callaboca" tract, which is situated near the old Panama-Cruces trail a short distance south of Cruces and the Santa Cruz estate near Gamboa.

On March 7 the survey work of the Panama Railroad in connection with the land department was turned over to this division. During the remaining three and a half months of the fiscal year corner stakes were set on 168 lots and gutter stakes on 25, a total of 193 lots. Corner and grade stakes were set on 106 lots, all of which were in the cities of Colon and Panama. Corner stakes only were set on 62 lots which were distributed along the line in the districts where the Panama Railroad has lot layouts from New Gatun to Culebra.

A survey was made and map drawn up of block 1, Folks River, giving exact distances and angles to be used in a proposed replot of this block.

A survey was made of the Empire-Culebra lot layout and an adjustment made of the Panama Railroad Co. maps of this district. Ties were made to established property lines and to the Panama Railroad main line, and most of the boundary lines between the different districts were established. Iron rail and fishplate monuments were set throughout this work.

A location survey was made of the Golden Green (Culebra) lot layout monuments previously set, covering a section of 21 blocks.

The boundary line of the industrial lots, Panama, was run out and established by iron-rail monuments set in concrete. The boundary line fence of the Santa Cruz estate of the Panama Railroad Co., and the Domingo Dias holdings was completed in accordance with the agreement between the two parties.

A detailed survey was made of a large area near Ancon Hill, to the north of the Balboa Road and to the west of Avenida Ancon, showing the various properties and especially that part in dispute between the United States Government and private owners. A map was drawn up on a scale of 1:1,000.

Surveys and sketches were made of different plots of ground in Panama, Empire, Colon, and an agricultural plot near the Monte Lirio Road, 4 miles out from Mount Hope.

The Colon fire in April devastated a large area, which was built up almost immediately, and has required a great deal of additional work. A general check has been kept on the building construction in the cities of Colon and Panama.

An estimate was made of the yardage required to fill in an area of about 28 acres lying between E and G Streets, Colon, and extending from Thirteenth Street south to Folks River.

#### CANAL ZONE BOUNDARY.

Maps and plans were prepared showing the boundary lines between the Canal Zone and the Republic of Panama. The Canal Zone-Republic of Panama line in Colon was run out along the center of Eleventh Street to the sea wall, and in connection with this work a survey was made of the changed limits of the Folks River shore line (due to the dredging in the river). The geodetic positions of the boundary monuments around Panama City were computed from ties made to the triangulation system, and the azimuths and distances between monuments computed. The Curundu River, also known as the Rio Hondú and the Quebrada San Jose, was surveyed and mapped in connection with the boundary work.

A general map of the Canal Zone was revised, and a map was prepared showing the proposed changes of the boundaries of the city and harbor of Colon, and the city of Panama and harbor of Ancon.

Descriptions of the northeastern and southwestern boundaries of the Canal Zone, of the city of Colon, of the harbor of Colon, of the city of Panama, and of the harbor of Panama were also prepared for the use of the department of law.

Three monuments in the boundary line between the city of Panama and the Canal Zone were reset during the year, and many of the monuments at angles in all of the boundary lines have been tied to the triangulation system.

#### PRECISE-LEVEL BENCH MARKS.

The precise-level bench marks were visited in October, 1910, and in February, 1911, the grass and brush surrounding them being cleared away, the guard fences being repaired and painted, and the revised elevations painted on the pipes. One of these bench marks (6-A) was relocated.

#### MISCELLANEOUS.

The canal axis and the traverse base line between Gatun and Pedro Miguel were tied to the triangulation system. The geodetic positions of a number of points on the canal axis were computed from ties made to the triangulation or to base-line monuments, and by means of these the adjusted lengths and azimuths of the canal tangents have been computed.

The work of marking on the ground the 87-foot contour around the lake area, for the purpose of assisting the police department in preventing people from settling in the territory to be covered by the lake, was started in April, and on June 30 had been completed, except in the Gatun River Valley, about 10 days' work there remaining.

A traverse was made of the Arenal River, and a straight line established on the ground between the source of this river and the mouth of the Sweetwater River for the purpose of defining certain property requirements.

Plane-table topography within a radius of one-half mile of the locks at Pedro Miguel and Miraflores was taken, and a map has been made up on a scale of 1:10,000.

Numerous plans and descriptions of boundaries have been made up during the year for the use of the department of law.

The following plate accompanies this section:

PLATE 127. Triangulation map.

The following tables accompanying the report of this section are appended:

TABLE 18. Primary positions, triangulation survey.

TABLE 19. Secondary positions, triangulation survey.

TABLE 18.—*Geographic positions, Panama-Colon datum—Primary positions.*

[Adjustment made by United States Coast and Geodetic Survey, December, 1910.]

Stations.	Latitude and longitude.	Seconds in meters.	Azimuth.	Back azimuth.	To stations.	Distance.	Logarithms.
	° ' "		° ' "	° ' "		Meters.	
Toro Lighthouse.....	9 22 25.381	779.7	101 29 52.80	281 29 28.55	Toro Lighthouse.	4, 635.28	3. 6060763
Colon Lighthouse.....	9 21 57.680	234.3	288 06 54.82	108 08 02.44	Santa Rita.	13, 362.35	4. 1258589
Marconi wireless, pole 2 <sup>1</sup> .....	9 21 55.314	1, 696.3	352 24 24.08	172 24 30.90	Quebrancha.	9, 721.96	3. 9677494
Isthmian Canal north base <sup>1</sup> .....	9 21 54.811	1, 659.5	24 43 14.57	204 42 45.72	Gatun.	13, 003.89	3. 1140784
	9 21 54.018	37.4	11 27 39.2	191 27 37.8	Isthmian Canal south base.	1, 848.9	3. 697928
	9 20 51.271	1, 575.1	64 48 59.2	244 48 35.2	Limon Point.	4, 968.0	3. 697928
	9 20 51.271	701.8	98 24 55.0	278 24 30.6	First.	4, 642.5	3. 666754
Isthmian Canal south base <sup>1</sup> .....	9 20 08.241	253.2	176 16 07.2	356 16 06.1	Colon Lighthouse.	3, 296.4	3. 519041
	9 16 40.339	969.8	146 39 42.84	326 39 05.79	Toro Lighthouse.	12, 668.80	4. 1032308
Quebrancha.....	9 16 40.339	1, 239.3	165 53 45.68	345 53 32.77	Colon Lighthouse.	9, 977.27	3. 9960115
Gatun.....	9 15 26.511	906.6	178 51 59.10	338 51 57.76	Toro Lighthouse.	12, 778.55	4. 1064317
	9 15 26.511	1, 812.9	199 53 44.39	19 54 07.15	Colon Lighthouse.	12, 604.92	4. 1054603
	9 13 02.029	62.3	252 03 35.80	72 04 11.29	Quebrancha.	7, 066.07	3. 8491782
Lake.....	9 13 02.029	106.2	116 39 11.51	296 38 24.00	Gatun.	10, 102.49	4. 0042386
Santa Rita.....	9 13 02.029	1, 186.3	161 01 32.99	341 01 20.84	Quebrancha.	7, 092.17	3. 8507794
	9 13 02.029	154.1	36 47 35.74	216 46 37.62	Lake.	15, 216.07	4. 1823025
	9 13 02.029	154.1	67 07 50.22	244 21 02.79	Quebrancha.	12, 663.89	4. 1025499
	9 13 02.029	522.1	105 34 24.18	285 32 46.21	Gatun.	19, 068.82	4. 2807674
Salud.....	9 13 02.029	181.7	88 24 26.72	268 51 03.66	Colon Lighthouse.	14, 468.84	4. 164157
	9 13 02.029	522.1	148 06 42.79	328 06 39.39	Lake.	16, 417.74	4. 2153153
Balboa.....	9 04 57.637	1, 770.7	134 04 05.20	314 38 04.24	Santa Rita.	13, 812.02	4. 1402573
Salvador.....	9 04 57.637	1, 536.4	185 02 39.54	5 02 46.60	Salud.	15, 400.89	4. 3257609
Gordo.....	9 02 53.458	1, 763.5	136 57 30.94	316 56 51.31	Balboa.	11, 100.25	4. 0453329
	9 02 53.458	1, 763.5	124 22 39.27	304 22 03.54	Salud.	11, 491.39	4. 0453329
Gigante.....	9 02 53.458	1, 763.5	189 31 39.46	9 31 49.86	Salvador.	12, 153.25	4. 0537770
East.....	9 02 53.458	1, 763.5	189 32 06.80	6 32 15.77	Lake.	14, 060.31	4. 1591054
	9 02 53.458	1, 763.5	232 29 51.50	93 01 17.74	Balboa.	14, 060.31	4. 1591054
	9 02 53.458	233.3	372 27 26.81	132 27 48.68	do.	14, 060.31	4. 1591054
	9 02 53.458	233.3	60 07 39.97	240 06 54.87	Gigante.	14, 060.31	4. 1591054
	9 02 53.458	233.3	122 11 43.21	302 10 46.36	Lake.	12, 859.46	4. 1063474

West.....	9 00 34.089	1,047.3	163 17 29.54	343 17 19.60	do	6 600.78	3 5241135
	79 51 00.759	23.1	272 52 50.50	62 53 27.77	East.....	8 900.51	3 5232411
Tabarrulla south base.....	9 07 44.997	1,379.3	302 31 36.46	122 52 44.72	Balboa.....	5 648.45	3 1944713
	79 46 18.490	1,644.5	124 04 13.05	303 05 51.15	West.....	4 983.22	3 7763546
Frijoles.....	9 09 48.100	1,478.0	223 59 31.06	83 59 51.88	East.....	4 938.94	3 6935985
	79 46 17.041	520.3	86 04 43.54	295 04 17.48	West.....	5 016.94	3 7043985
			130 44 51.82	310 44 15.63	East.....	9 127.89	3 9403702
			282 54 57.82	102 55 18.43	East.....	4 017.94	3 8072387
Escorial.....	9 09 30.335	931.9	06 40 10.73	180 40 10.50	Tabarrulla south base.....	3 785.45	3 5731180
	79 57 38.872	1,171.5	186 09 13.53	6 09 19.32	Gatun.....	11 098.27	4 0432451
			311 01 52.73	57 02 19.35	Lata.....	12 114.37	4 0833004
Daniels.....	8 59 50.385	1,547.9	120 53 05.44	359 52 01.98	Gigante.....	11 425.14	4 0578514
	79 46 11.836	361.5	204 36 01.56	24 36 24.11	Balboa.....	16 089.34	4 2045583
			247 18 27.07	67 19 24.53	do.....	10 881.56	4 0163923
Iron.....	9 05 14.651	450.1	62 35 13.87	242 35 21.51	Gordo.....	12 191.94	4 0807727
	79 34 31.314	955.2	129 30 12.66	305 50 30.42	Salvador.....	11 528.11	4 0570745
Ancon.....	8 57 23.826	784.2	125 51 23.51	305 50 18.62	Gordo.....	10 543.26	4 0239760
	79 33 08.813	269.2	170 05 04.07	350 04 51.13	Iron.....	15 627.73	4 1829068
	8 55 34.822	1,089.8	116 28 41.31	296 27 20.88	Daniels.....	17 615.87	4 2459041
Cobra.....	79 37 33.803	1,087.7	160 12 20.08	340 11 56.98	Gordo.....	13 341.82	4 1253054
			247 20 40.27	67 21 21.77	Ancon.....	8 831.30	3 9440245
Espinoza.....	9 00 50.806	1,580.8	32 23 45.24	212 23 24.77	do.....	7 468.52	3 8732244
	79 30 57.826	1,766.3	51 23 14.28	231 23 12.23	Cobra.....	15 552.25	4 1917963
			141 11 31.84	231 10 53.24	Iron.....	10 402.36	4 0171317
Panama Cathedral spire (southeast tower).....	8 57 13.676	420.1	102 50 14.95	282 50 08.60	Ancon.....	3 2144476	3 2144476
	79 32 16.516	504.5	190 48 53.21	19 49 05.50	Espinoza.....	7 090.25	3 8506513
	8 59 48.324	1,484.9	244 05 52.06	64 05 12.32	do.....	4 383.78	3 8428538
Cedro!.....	79 33 07.229	220.8	341 56 26.57	161 56 34.48	Panama Cathedral.....	4 997.37	3 9957418
			0 37 54.14	180 37 53.68	Ancon.....	4 387.46	3 9422130

! Secondary station; position adjusted by the United States Coast and Geodetic Survey.



TABLE 19.—*Geographic positions, Panama Colon datum—Secondary positions.*

[Adjusted to primary positions by third division, office of chief engineer, May, 1911.]

Stations.	Latitude and longitude.	Seconds in meters.	Azimuth.	Back azimuth.	To stations.	Distance.	Logarithms.
San Jose.....	8 54 16.193 79 30 53.461	497.4 1,633.3	144 35 35.24 101 07 53.97	324 35 14.25 281 06 51.64	Ancon.....	17,136.47	3.8534636
Venado.....	8 54 04.879 79 35 52.035	149.9 1,589.8	179 22 11.94 131 07 52.43	359 22 10.89 311 07 36.37	Cobra.....	12,521.18	4.0976452
Victoria.....	8 58 05.405 79 36 28.233	166.0 892.5	218 56 05.11 195 06 39.64	38 58 30.47 15 06 45.76	Espinosa.....	12,123.51	4.0836283
Miraflores.....	9 00 24.844 79 35 50.362	763.2 1,538.3	281 22 00.09 242 44 47.41	101 22 31.16 63 45 18.81	Cobra.....	7,928.40	3.6233303
Coccol.....	9 00 27.928 79 37 37.124	858.0 1,133.9	126 26 11.99 200 17 32.83	306 58 51.19 102 41 21.98	Ancon.....	4,437.15	3.6471038
Gausano.....	8 59 51.156 79 38 49.455	1,571.6 1,510.6	194 15 52.80 334 19 45.51	14 15 59.41 154 19 56.26	Miraflores.....	6,213.73	3.7835523
Hornigueros.....	9 00 03.557 79 41 50.282	109.3 1,535.8	93 57 00.03 344 00 44.01	273 56 31.75 164 00 55.51	Cedro.....	6,906.22	3.8392404
Chinal.....	9 01 27.980 79 43 45.640	889.6 1,394.0	194 22 21.49 242 54 58.26	14 23 37.50 63 55 09.58	Gausano.....	5,400.24	3.7032006
Luisa.....	9 01 28.517 79 37 01.567	906.8 47.8	264 27 50.81 247 03 40.75	267 05 41.30 67 04 04.90	Ancon.....	7,396.78	3.8698841
Mandinga.....	9 02 32.699 79 41 11.793	1,004.6 280.2	255 53 46.29 306 21 14.60	75 54 21.16 126 21 32.68	Cedro.....	5,107.41	3.7032006
			56 07 28.02 106 36 03.05	236 07 05.10 33 33 56.46	Gausano.....	5,708.73	3.7565388
			213 33 32.80 316 30 33.86	289 35 34.47 136 31 10.25	Calmitillo.....	5,206.41	3.7165382
			157 42 41.73 277 46 12.74	337 42 31.00 97 46 23.47	Pienzo.....	6,594.67	3.8191928
			132 36 37.06 226 30 11.03	812 36 12.08 43 30 31.22	Gordo.....	5,196.72	3.7157290
					Hornigueros.....	2,491.36	3.3946898
					Cobra.....	4,730.16	3.6746761
					Mandinga.....	5,394.03	3.7319134
					Daniel.....	7,969.22	3.9080478
					Coccol.....	7,768.59	3.8903424
					Gordo.....	5,102.03	3.7077434
					Mandinga.....	6,994.00	3.8447259
					Hornigueros.....	4,375.00	3.6409781
					Daniels.....	5,378.50	3.7206608
					Gordo.....	5,769.26	3.7633743
					Iron.....	8,300.06	3.9190811
					Ancon.....	10,330.83	4.0141394
					Pasa.....	5,468.67	3.7394668
					Gordo.....	2,103.89	3.3202010
					Balboa.....	6,877.34	3.8196506
					Semaphor.....	5,548.11	3.7441450

Viejo.....	9 03 25.068 79 43 35.460	796.1 1,083.0	290 19 02.66 4 55 06.22 173 37 56.35 270 53 15.20 213 43 24.60 316 24 01.69 13 00 39.35 104 53 04.51 144 16 56.97 81 09 47.26 196 20 36.25 329 02 26.47 42 32 44.61 68 41 34.04 232 14 34.18 108 33 29.91 228 40 40.02 263 42 26.13 21 33 57.65 92 42 01.36 182 13 44.40 279 57 27.43 322 09 19.29 77 13 12.74 223 04 26.25 291 49 00.55 15 52 12.62 167 59 34.27 84 18 53.26 301 33 23.61 139 49 09.46 18 23 46.80 96 20 33.00 172 00 20.92 271 41 02.07	110 19 25.26 184 56 04.63 152 88 15.87 350 53 12.78 33 43 36.46 136 24 16.20 198 00 33.55 264 52 41.64 324 16 37.89 261 09 00.83 16 20 42.10 149 02 45.47 222 32 21.25 52 14 51.69 268 33 03.86 118 40 51.65 83 43 09.74 201 33 48.81 272 41 16.69 2 13 45.93 99 57 57.52 142 09 40.77 257 12 58.44 43 04 58.25 111 49 38.54 185 52 06.92 347 59 30.08 264 18 41.89 121 33 50.23 319 49 53.89 196 23 34.01 275 19 58.31 332 00 15.12 91 41 35.77	Mandinga. Chinal..... Hormigueros Balboa..... Poesa..... Espinoza..... Cedro..... Caimitillo..... Iron..... Gordo..... Iron..... Cedro..... Coccol..... Iron..... Semaphor..... Caimitillo..... Iron..... Gordo..... Balboa..... Salvador..... Semaphor..... Gordo..... Balboa..... Salvador..... Iron..... Semaphor..... Salvador..... Casaya..... Iron..... Salvador..... Balboa..... East..... Salud..... Salvador.....	4,678.78 3,628.38 6,988.99 2,963.96 4,152.56 3,6183.158 3,61222.239 3,70012.033 3,69856.10 3,80148.57 3,99015.86 3,60419.26 3,85694.50 3,8273.701 3,89092.38 3,63186.20 3,72619.81 3,41021.09 3,92853.83 3,6667.52 3,99632.25 3,88314.44 3,77578.66 3,83194.33 3,45163.35 3,96615.62 3,89765.23 3,69412.79 3,56857.4 3,34385.65 3,78249.2 3,66719.68 3,89313.96 3,82536.21 3,99304.50 3,8107.817
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## EXPLORATIONS.

The exploration of the low places on the westerly borders of the proposed Gatun Lake, which work was started in February, 1909, was completed in January, 1911. The section explored during the year was between Gatun and the headwaters of the Gatun River. The same methods were followed as in previous years, the amount and extent of the material being determined by the diamond drill and topographical and geological surveys, and their stability and permeability by special tests. During the year explorations were made in the following places:

## CANOA.

The Canoa saddles are located at the headwaters of the Quebrada Canoa, about 10 miles northeast of Gatun in approximate latitude  $9^{\circ} 20' 30''$ , longitude  $79^{\circ} 48' 30''$ . Within a distance of about 1 mile six saddles were found with elevations, respectively, of +121.3, +138, +142.5, +138.5, +160.4, and +104.7, in each of which saddles one hole was drilled, these holes being stopped at the following respective elevations: -120.1, -10.6, +32.2, +42.9, +70.3, and -18.9. A hole was drilled on each side of the divide at saddle +121.3—surface elevations 69.5 and 72.7, bottom elevations -12.1 and -16.8. Similar holes were drilled on each side of the divide at saddle 104.7—surface elevations 92.5 and 86.6, bottom elevations -20.5 and -38.9, respectively. The thinnest place in the ridge at elevation +85 is about 250 feet thick in saddle at elevation of +104.7, and the next thinnest place is about 375 feet in saddle at elevation of +121.3. The materials found underlying saddles of elevations of +121.3, +138, +142.5, +138.5, and +160.4 were mostly clay, sand, and gravel. Practically no water was lost while drilling in these saddles, and since the drilling has been finished the ground water stands in all holes above elevation +90, which is taken as an indication of conditions adverse to seepage. Extensive tests showed no movement of underground water, and it does not appear that there will be any percolation through these saddles. The materials found underlying the saddle at elevation +104.7 were clay, decomposed rock, and argillaceous sandstone. While drilling the hole on this saddle, part of the water, about 0.5 of a cubic foot per minute, was lost at elevation +87.7 at the change from decomposed rock to argillaceous sandstone, but no water was lost while drilling the holes on each side of the divide, and as subsequent tests showed no movement of underground water, and the ground water stands above elevation +87, this saddle may also be considered safe.

## BARRO.

This saddle is located at the head of the Quebrada Barro, about 8 miles northeast of Gatun in approximate latitude  $9^{\circ} 20' 30''$ , longitude  $79^{\circ} 50'$ . The elevation of the saddle is +141.9 and the thickness of the ridge at elevation 85 is 360 feet. Two holes were drilled at this place, one on the divide and one on the Atlantic slope, with surface elevations, respectively, of +149.9 and +89.4 and bottom elevations of -11.9 and -17.6. The materials found underlying

this saddle were clay and argillaceous sandstone. No water was lost while drilling, and further tests after the holes were completed showed no seepage or movement of underground water.

In connection with this work a hole was also drilled on the divide about one-half mile east of the Barro saddle to determine whether or not a stratum of limestone passed through the ridge at this place. The materials found were clay and decomposed rock from surface (elevation +205) to elevation +189.7, and then argillaceous sandstone to bottom (elevation +81.7), except at elevation +150.7 and +115.7, which is well above lake level (high-water elevation +87), where thin strata of limestone 12 inches and 15 inches in thickness were found. Test pits were also dug on each side of the divide where limestone outcrops, and it was found to be only a thin stratum from 1 to 3 feet thick and to lie on top of the argillaceous sandstone. No water was lost while drilling this hole. These investigations indicate that no seepage may be expected through the divide at this place.

#### EGRONAL.

The Egronal saddles are located at the head of the Quebrada Egronal about 5 miles northeast of Gatun and about 2 miles southeast of Mount Hope in approximate latitude  $9^{\circ} 19'$  and longitude  $79^{\circ} 52' 30''$ .

Within a distance of about one-half mile three saddles were found with elevations respectively of +157.3, +129, and +137.7, in each of which one hole was drilled, the holes being stopped at the following respective elevations: -23.2, -14, and -12.3. On each side of the divide at saddle of elevation +129 one hole was drilled with respective surface elevations of +94.3 and +86 and respective bottom elevations of -13.7 and -10.5.

The distance through the thinnest part of the divide at elevation +85 is about 350 feet, in the saddle of elevation +129. The materials found underlying the saddles were clay, decomposed rock, and argillaceous sandstone, the average depth to rock on the divide being 10 feet. No water was lost while drilling and seepage tests after the holes were completed showed the materials to be practically impervious.

The total length of ridge line covered by these investigations is about 50.1 miles, extending from the River Pavon about 31.4 miles southwesterly of Gatun to the Santa Rita Mountains about 18.7 miles northeast of the same station. This work is now completed, and the investigations have been thoroughly and carefully made. No limestone (except as noted above) or any other pervious materials have been found in the investigations in these ridges.

The indications are that these ridges are of such thickness and are composed of such materials that they will be practically water tight, and will permit of no appreciable loss of water from Gatun Lake. At the Cano saddle, as reported last year, it probably will be necessary to construct a dike or wall, as the present surface is too low to properly safeguard the lake at this point, and some similar but less extensive work will probably be required at the headwaters of the Las Gaucas Creek, about one-half mile east of Gatun and near the Gatun-Mount Hope Road.

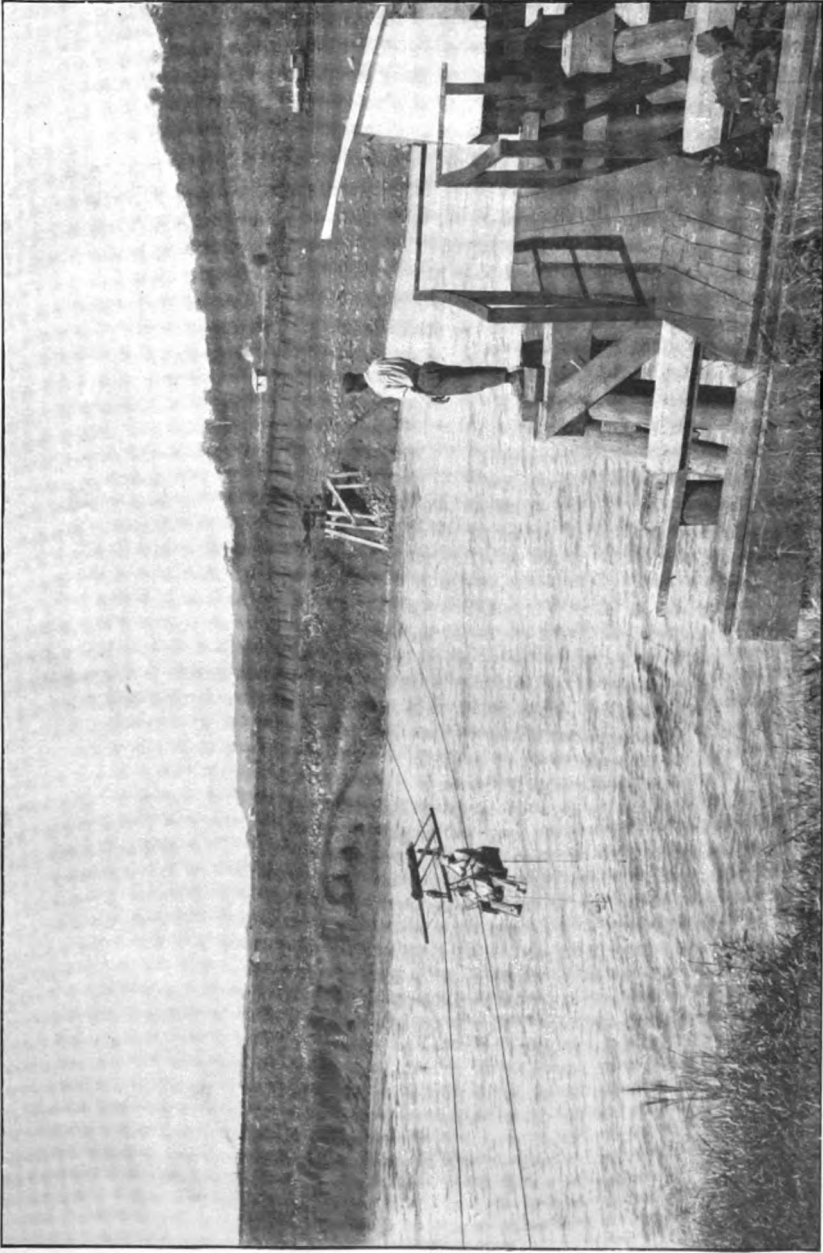
## SPECIAL INVESTIGATIONS.

The work of this section has included the review and comment upon such matters as have been submitted for special study by the chief engineer.

Respectfully submitted.

C. M. SAVILLE,  
*Assistant Engineer.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*



GAUGING STATION, GATUN SPILLWAY, JUNE, 1911.



## APPENDIX I.

### REPORT OF AD. FAURE, COST-KEEPING ACCOUNTANT IN OFFICE OF CHAIRMAN AND CHIEF ENGINEER.

ISTHMIAN CANAL COMMISSION,  
OFFICE OF CHAIRMAN AND CHIEF ENGINEER,  
*Culebra, Canal Zone, August 31, 1911.*

SIR: I have the honor to submit the following report of the work of this office for the fiscal year 1911. Its duties consist in supervising and verifying the statements of costs furnished by the division engineers, establishing accounts for new work, preparing statistical reports, and attending to such other matters as may be assigned to it by the chief engineer.

No change was made during the year in the cost-keeping method finally adopted January 1, 1910, and the results have been satisfactory. Costs of the main features of the work for the month have been furnished about the 20th of the month following. Commencing with the first quarter of the fiscal year, cost tables have been published quarterly in the Canal Record, not later than the first issue in the second month following the close of the quarter. As the Canal Record is distributed to all American employees and is also distributed in the United States, these figures have been given wide publicity.

During the year classifications were established for the work of buoying and lighting the canal and the construction of docks at Balboa and Cristobal. Expenses for buoying and lighting the canal have been carried under "General items" up to June 30; hence do not appear on Exhibit A—"Statement of construction expenditures." The detail of these expenses, however, are shown under Exhibit B—"Detail cost per unit of work." These expenditures will appear as a unit of canal construction under "Construction and engineering" after July 1.

From July 1, 1910, reports showing the performance of rock-producing plants and of concrete producing and handling plants have been prepared, and these reports, consolidated for the year, appear under Exhibit C. Exhibit D is a comparative statement of the overhead expenses for the fiscal year 1910-11. Exhibit E is a statement of the salary expenditures of the commission classified under appropriation heads.

#### EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911.

These statements represent the amount expended for the actual construction of the canal, a total of \$123,386,129.78, segregated by units of work between construction divisions and between actual



division cost (including plant and equipment) and overhead expenses, the total by divisions being as follows:

Divisions.	Division cost.		Overhead expense.		Total cost.	
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Atlantic.....	\$31,396,497.72	27.86	\$2,463,875.44	23.04	\$33,860,373.16	27.44
Central.....	61,320,222.09	54.42	6,617,892.70	61.88	67,938,114.79	55.06
Pacific.....	19,974,796.49	17.72	1,612,848.34	15.06	21,587,644.83	17.50
Total.....	112,691,518.30	100.00	10,694,611.48	100.00	123,386,129.78	100.00

It will be seen that the division of general expenses has resulted in a surcharge of 7.85 per cent to the Atlantic division, 10.79 per cent to the central division, and 8.07 per cent to the Pacific division over division costs. The reason for the high percentage assigned to the central division is that prior to 1907 but little work was done in the Atlantic and Pacific divisions; the overhead expenses were nearly all charged to the central division, and the per cent of these expenditures to the division expenditures was very high during the first years of construction.

It will be noted that the unit costs produced during the fiscal year are with but few exceptions lower than for any previous period. Dry filling the Gatun Dam shows an increase in division cost over the previous year of \$0.0847, due to the increased height, which necessitated more power in handling the material. Dredging excavation in the Pacific division shows an increase in division cost over the previous year of \$0.0111, due mainly to longer haul of spoils to dumps and to increased depth of excavation.

#### EXHIBIT B.—DETAILED COST PER UNIT OF WORK.

##### DRY EXCAVATION.

The quantities and average division cost of dry excavation during the year were:

Nature of work and location.	Quantity.	Average division cost per cubic yard.
Excavation in spillways and locks:	<i>Cubic yards.</i>	
Gatun spillway.....	125,363	\$0.4069
Gatun locks.....	475,875	.7110
Pedro Miguel locks.....	16,423	.5691
Miraflores locks.....	247,700	.7378
Excavation in canal prism:		
Atlantic division.....	280,305	.6010
Central division—		
By division forces.....	18,344,424	.5602
By contractors.....	178,268	.3600
Total central division.....	18,522,692	.5680
Pacific division.....	198,770	.6900
Preparing foundations for masonry:		
Gatun spillway.....	32,245	1.5048
Gatun locks.....	152,582	1.5549
Pedro Miguel locks.....	76,847	2.3746
Miraflores locks.....	137,732	1.6085

When it is considered that the Atlantic and Pacific divisions used nearly all the excavated material in the construction of dams and fills adjacent to the points from which the material was excavated and charged to the work benefited all expenses of this dumping, while the central division had long hauls to their dumps and nearly all expenses for dumping are included in their cost, it will be seen that the latter division produced by far the lowest cost. During the month of March that division excavated 2,000,631 cubic yards of material, at a division cost of \$0.4786. The unit cost for that month, as well as that for the year, are the lowest since the beginning of the construction of the canal, and are not likely to be repeated.

## DREDGING EXCAVATION.

The plant engaged on this work during the year was: In the Atlantic division, one sea-going suction dredge, two dipper dredges, and three ladder dredges, and one pipe-line suction dredge from October to March, inclusive; in the Pacific division, one sea-going suction dredge, one dipper dredge, and three ladder dredges. The quantities dredged by the various classes of dredges and the average division cost per cubic yard, for operation and repairs, were:

Class of dredge.	Atlantic division.			Pacific division.		
	Number.	Quantity.	Average cost per cubic yard for operation and repair.	Number.	Quantity.	Average cost per cubic yard for operation and repair.
		<i>Cubic yards.</i>			<i>Cubic yards.</i>	
Sea-going suction .....	1	3,180,196	\$0.0452	1	2,904,435	\$0.0569
Dipper .....	2	590,448	.1346	1	738,139	.1371
Ladder .....	3	1,221,092	.1496	3	1,907,068	.0963
Pipe-line suction .....	1	836,569	.0818	.....	.....	.....

In the Atlantic division the average cost of pipe lines and dikes in connection with the pipe-line dredge was \$0.0803 per cubic yard. The dikes constructed will be used to retain all the excavation by pipe-line dredges in that division, so the above unit cost is not proportionate to the quantities dredged this year. The cost of disposing of spoils excavated by dipper and ladder dredges was: Atlantic division, \$0.1355 per cubic yard, and Pacific division \$0.0917 per cubic yard. The total quantities of material excavated by and the division cost per cubic yard for all dredges, including auxiliary expenses, was: Atlantic division, 5,828,345 cubic yards, average cost, \$0.2215; Pacific division, 5,549,642 cubic yards, average cost, \$0.2519. Owing to an underestimation of the quantities to be handled by dredges in the Pacific division, and to changes of plans, the total cost of the dredging plant had been absorbed with the accounts for the month of April, and no further charge will be made against that work for "Plant arbitrary," unless new equipment be put into commission.

## HYDRAULIC EXCAVATION.

The quantities and cost of hydraulic excavation for the year were: Atlantic division, prism, 28,605 cubic yards, average division cost

\$0.2699 per cubic yard; Pacific division, prism, 197,677 cubic yards, average division cost \$0.6106 per cubic yard; Miraflores locks, 332,703 cubic yards, average division cost \$0.5486 per cubic yard. This work in the Atlantic division consists in washing out the mud which had accumulated in the Mindi Cut while it was flooded and no special plant was installed, the pump previously used to unwater the pit handling this material.

#### MASONRY.

There was a total of 1,741,908 cubic yards of masonry laid in the spillways and locks during the year. In Gatun spillway 59,651 cubic yards were laid at an average division cost of \$6.7044 per cubic yard; in Gatun Locks 902,926 cubic yards, average division cost \$6.5919, and 8,211 cubic yards of reinforced concrete, average division cost \$12.4487 per cubic yard, a total of 911,137 cubic yards, at a total average division cost of \$6.6447 per cubic yard. In Pedro Miguel locks 497,802 cubic yards, average division cost \$4.7040 per cubic yard, and 385 cubic yards of reinforced concrete, average division cost of \$17.7426 per cubic yard, a total of 498,187 cubic yards, at a total average division cost of \$4.7141 per cubic yard; in Miraflores locks, 272,933 cubic yards, average division cost \$4.6826 per cubic yard. The lowest average costs per cubic yard produced in any one month during the year were: Gatun spillway, February, 6,609 cubic yards at \$5.7744; Gatun locks, March, 85,299 cubic yards at \$6.1500; Pedro Miguel locks, November, 64,248 cubic yards at \$4.1964; Miraflores locks, May, 36,154 cubic yards, \$4.0464. The difference between the costs in the Atlantic division and Pacific division is mainly due to difference in cost of cement, sand, and stone. The bulk of the cement used in the Atlantic division was received in barrels, at a cost of \$1.19, tidewater in the United States, while the Pacific division received its cement in bags at a cost of \$1.60 per barrel, less drawback for bags returned to contractors. As approximately 90 per cent of the bags have been returned to contractors and accepted by them, cement has cost that division about \$1.01 per barrel, tidewater in the United States. There has also been economy in handling the cement after its receipt on the Isthmus, the Pacific division handling a large percentage direct from cars to mixers, while nearly all the cement of the Atlantic division was handled through its storehouse. The difference in cost of stone and sand is discussed under the head of "Stone production" and "Sand production."

The following is a comparative statement in detail of division cost at Gatun and Pedro Miguel locks for this year:

	Gatun locks.	Pedro Miguel locks.
Concrete.....cubic yards..	630,317	495,037
Cement.....	\$1.7784	\$1.5345
Stone.....	2.0960	.8242
Sand.....	.8614	.3739
Mixing.....	.1756	.1771
Total cost of concrete.....	4.9114	2.9107
Large rock.....cubic yards..	73,608	2,765
Cost.....	\$1.3366	\$1.1433

	Gatun locks.	Pedro Miguel locks.
Masonry.....cubic yards..	902,926	497,802
Concrete.....	\$4.5111	\$2.8945
Large rock.....	.1090	.0064
Forms.....	.4869	.4387
Placing.....	.3285	.3118
Reinforcements.....	.0241	.0867
Pumps.....	.0417	.0343
Power.....	.0608	.0454
Maintenance of equipment.....	.2357	.1723
Plant arbitrary.....	.6099	.6847
Division expense.....	.0914	.0792
Total division cost.....	6.5919	4.7040

It will be seen that the cost at Pedro Miguel was less by \$1.8879 per cubic yard. Analyzing the factors entering into the masonry cost, there is a difference in favor of Pedro Miguel locks of \$1.7340 per cubic yard in the cost of cement, sand, stone, and large rock; \$0.0482 in forms; \$0.0167 in placing; \$0.0074 in pumping; \$0.0212 in power; \$0.0634 in repairs; \$0.0122 in plant arbitrary and \$0.0122 in division expense, while there is a difference in favor of the Gatun locks of \$0.0148 in mixing and \$0.0126 in reinforcements. Comparing the cost of large rock with that of concrete, there was a saving by its use of \$263,137.45 at Gatun locks, and of \$4,873.04 at Pedro Miguel locks.

The construction plant at Pedro Miguel was completed in July, and on February 1 the work of dismantling it for removal to Miraflores was commenced, and from that date, owing to the decreased output, the cost has increased. Unit costs for the period August to January, inclusive, when the plant was operated in its entirety, are shown in subjoined table with comparison of costs at Gatun locks for the year, that plant having been operated at its entirety during the whole period.

	Gatun locks.	Pedro Miguel locks.
Concrete.....cubic yards..	829,317	306,984
Cement.....	\$1.7784	\$1.5436
Stone.....	2.0960	.8039
Sand.....	.8614	.3779
Mixing;		
Construction plant.....	.1749	.1884
Auxiliary plant.....	.1776	.2951
Total.....	.1758	.1528
Total cost, concrete.....	4.9114	2.9782
Large rock.....cubic yards..	73,609	1,999
Cost.....	\$1.3366	\$1.0132
Masonry.....cubic yards..	902,926	306,983
Concrete.....	\$4.5111	\$2.8506
Large rock.....	.1090	.0066
Forms.....	.4869	.3751
Placing.....	.3285	.2756
Reinforcements.....	.0241	.0309
Power.....	.0608	.0460
Pumps.....	.0417	.0337
Maintenance of equipment.....	.2357	.1733
Plant arbitrary.....	.6099	.6717
Division expenses.....	.0914	.0732
Total division cost.....	6.5919	4.5451

It will be seen that under practically similar conditions the cost at Pedro Miguel was less by \$2.0468 per cubic yard. Analyzing the factors entering into masonry costs, there are differences in favor of Pedro Miguel of \$1.7444 in cost of cement, stone, sand, and large rock; \$0.0095 in mixing; \$0.1118 in forms; \$0.0080 in pumping; \$0.0216 in power; \$0.0620 in repairs; \$0.0529 in placing; \$0.0252 in plant arbitrary, and \$0.0182 in division expense, while there is a difference in favor of Gatun locks of \$0.0068 in reinforcements. It is also noted that mixing by the construction plant at Pedro Miguel cost \$0.1334, and at Gatun \$0.1749, per cubic yard of concrete.

#### DRY FILLING.

The quantities of dry filling placed in the various projects and the average division cost thereof per cubic yard were:

Nature of work and location.	Quantities.	Average division cost per cubic yard.
	<i>Cubic yards.</i>	
Gatun Dam.....	2,653,906	\$0.3813
Gatun-Mindí levee.....	51,156	.1979
Miraflores Dam.....	295,598	.4102
Back filling spillway and lock walls:		
Gatun spillway.....	12,873	.4832
Gatun locks.....	535,669	.5307
Pedro Miguel locks.....	273,709	.3900
Miraflores locks.....	53,521	.4293
Filling center wall, Gatun locks.....	2,717	1.0634
Filling for foundation of approach wall, Gatun locks.....	22,234	1.1839
Colon breakwater.....	359,890	1.4506

The largest quantity placed in Gatun Dam in any one month was in November, when 266,105 cubic yards were placed at an average division cost of \$0.3363 per cubic yard. The lowest cost during the year was in July, when 180,111 cubic yards were placed at an average cost of \$0.3179 per cubic yard.

#### HYDRAULIC FILLING.

There was pumped between the toes of the Gatun Dam 4,256,393 cubic yards of hydraulic fill, at an average division cost of \$0.2289 per cubic yard. The largest quantity pumped in any one month was in October, when 480,732 cubic yards were placed at an average division cost of \$0.1700 per cubic yard, the lowest unit cost produced during the year. The low cost shown for the month of May is apparent only, and was due to heavy credits for dredge repair parts, previously charged to the work, which were returned to stock.

#### STONE PRODUCTION.

The Atlantic division's Porto Bello quarry produced 864,033 cubic yards of crushed stone at an average division cost of \$1.3862 per cubic yard. Transportation and unloading at storage piles at Gatun cost an average of \$0.9541, resulting in an average cost of \$2.3403 per cubic yard delivered in storage at Gatun. The Pacific division's Ancon quarry produced 855,824 cubic yards of crushed stone at an

average division cost of \$0.7113 per cubic yard. Transportation to storage piles at Miraflores and Pedro Miguel cost \$0.1330 per cubic yard, resulting in an average cost of \$0.8443 per cubic yard delivered in storage.

The quantities used in compiling the monthly cost sheets for the Ancon quarry were based on an estimate of the capacity of the cars loaded at the quarry. Cross-section measurements of the storage piles indicated that the actual quantities produced far exceeded these estimates, and in order to bring the book account in balance with the actual quantity on hand June 30, 82,652 cubic yards were added on the cost sheets in the column "Total for the year," but no changes were made in the monthly quantities produced and previously published. The performance sheet, however, was corrected back to agree with the monthly quantities produced, as indicated by measurements of storage piles. The difference in average cost per cubic yard of crushed stone delivered in storage at Gatun and at Pedro Miguel and Miraflores is shown in detail in the following table:

	Porto Bello.	Ancon.
Crushed stone.....cubic yards..	864,033	855,824
Quarrying:		
Stripping.....	\$0.0174	\$0.0476
Drilling.....	.0450	.0440
Blasting.....	.1980	.0421
Loading.....	.0921	.0452
Transportation.....	.0758	.0727
Tracks.....	.0464	.0243
Power.....	.0289	
Maintenance of equipment.....	.0981	.0333
Plant arbitrary.....	.3350	.2447
Total.....	.9367	.5548
Crushing:		
Operation crushers.....	.0355	.0172
Stone bins and conveyers.....	.0311	.0045
Power.....	.0394	.0183
Maintenance of equipment.....	.1158	.0175
Plant arbitrary.....	.1726	.0762
Total.....	.3944	.1337
Division expense.....	.0561	.0228
Total cost of production.....	1.3862	.7113
Towing:		
Operation tugs and barges.....	.1592	
Maintenance of equipment.....	.1063	
Plant arbitrary.....	.1975	
Total.....	.4630	
Unloading:		
Operation cableways and cranes.....	.1168	
Power.....	.0195	
Maintenance of equipment.....	.0929	
Plant arbitrary.....	.2050	
Total.....	.4342	
Rail transportation to storage:		
Cubic yards transported.....	275,148	855,824
Operation of trains.....	\$0.0819	\$0.0447
Repairs to tracks.....	.0142	.0075
Dumping in storage.....	.0155	.0098
Maintenance of equipment.....	.0672	.0157
Plant arbitrary.....		.0553
Total.....	.1788	.1330
Total cost in storage.....	2.3403	.8443

Crushed stone from Porto Bello is transported to Gatun in barges and unloaded by cableways and derricks, while crushed stone from Ancon is transported from quarry by rail to storage and dumped from a trestle; thus there is an extra expense attached to Porto Bello stone, represented by the differences between the cost of towing and unloading and that of transporting by rail of \$0.7184 per cubic yard. If this be deducted from the actual cost in storage, \$2.3403 per cubic yard, it leaves a cost per cubic yard of \$1.6219, which represents similar items to those entering into the cost of stone produced at Ancon quarry, \$0.8443 per cubic yard. In this connection it is interesting to note the quantities of crushed stone produced and costs thereof under different conditions that obtained during the year at Porto Bello and Ancon quarries. During the months of July and August the Porto Bello quarry was operated 16 hours per day. At Porto Bello the large crusher was placed in operation in September and the quarry operated 12 hours per day during the months of October, November, and December and part of January. On January 16 the working time was reduced to 10 hours and on February 15 to 8 hours, and the quarry operated on that working time to the close of the year.

Ancon quarry was operated 9 hours per day from July 1 to November 30, 12 hours per day from December 1 to April 4, and 9 hours per day from April 5 to June 30. The quantities produced and the average cost per cubic yard during these various periods at each quarry were:

	Porto Bello quarry.			Ancon quarry.	
	July and August, 16 hours per day without large crusher.	October to January, 12 hours per day with large crusher.	March to June, 8 hours per day.	July to November and April to June, 9 hours per day.	December to March, 12 hours per day.
Crushed stone..... cubic yards..	137,921	309,095	275,042	546,583	309,242
Average per month..... do.....	68,960	77,274	68,760	68,322	77,310
Quarrying.....	\$1.2064	\$0.9225	\$0.8100	\$0.5220	\$0.6129
Crushing.....	.3921	.4020	.3865	.1335	.1342
Division expense.....	.1159	.0482	.0301	.0211	.0258
Total cost of production.....	1.7114	1.3727	1.2266	.6766	.7729

The quantities shown under Ancon quarry in the above statement are the corrected monthly quantities appearing on performance sheet.

During the period of 12-hour workday at Porto Bello the average monthly quantity produced exceeded the average monthly quantity produced during period of 8-hour workday by 8,514 cubic yards, or 12.38 per cent, and the average cost per cubic yard was greater by \$0.1461, or 11.91 per cent. During the period of 12-hour workday at Ancon the average monthly quantity produced exceeded the average monthly quantity produced during the period of 9-hour workday by 8,988 cubic yards, or 13.16 per cent, and the average cost per cubic yard was greater by \$0.0963, or 14.23 per cent.

#### SAND PRODUCTION.

During the fiscal year the Atlantic division produced at Nombre de Dios 441,919 cubic yards of sand at an average division cost of

\$0.8795 per cubic yard. Transportation to Gatun cost an average of \$0.9770 per cubic yard, making an average total cost in storage of \$1.8565 per cubic yard. The Pacific division produced at Chame 494,841 cubic yards of sand at an average cost of \$0.1788 per cubic yard. Transportation to Pedro Miguel and Miraflores cost an average of \$0.6496 per cubic yard, making an average total cost in storage of \$0.8284 per cubic yard. The cost sheets of the Pacific division were based on estimated car capacities, and cross section of the stock piles developed an excess quantity of 18,249 cubic yards, which were added on the cost sheets to the total quantity produced during the year and on the performance sheet of the unloading crane to the quantity produced during the month of June. Except during the first four months of the year, when 29,539 cubic yards were obtained at Nombre de Dios by cranes, the method of securing the sand was similar at both points, the Atlantic division dredging the sand with pipe-line suction dredges and the Pacific division with a ladder dredge. In both divisions the sand was transported by water to the point of unloading, the distance being about 40 miles on the Atlantic side and 20 miles on the Pacific side. The Atlantic division used cableways and cranes to unload the sand, the Pacific division using electric cranes. Fifty-four and seventy-three one-hundredths per cent of the output of the Atlantic division was unloaded by cableways directly into the storage piles and 37.70 per cent unloaded by derricks near lock site and transported by rail to storage piles or mixers. Seven and fifty-seven one-hundredths per cent was unloaded by derricks near spillway mixer. All the output of the Pacific division was transported by rail to storage piles. The difference in the cost of the two divisions is shown in detail in the following comparison:

	Nombre de Dios.	Chama.
Excavation.....cubic yards..	29,539	
Blasting.....	\$0.0194	
Loading by cranes.....	.2091	
Tracks.....	.1228	
Transportation.....	.1033	
Trestles.....	.0416	
Dumps.....	.0099	
Pumps.....	.0354	
Maintenance of equipment.....	.2560	
Total.....	.7975	
Dredging.....cubic yards..	412,380	494,841
Operation of dredges.....	\$0.2444	\$0.0926
Maintenance of equipment.....	.1010	.0354
Total.....	.3454	.1280
Total produced.....cubic yards..	441,919	494,841
Operating cost.....	\$0.3756	\$0.1280
Plant arbitrary.....	.4740	.0300
Division expense.....	.0299	.0208
Total cost of production.....	.8795	.1788
Towing:		
Operation tug and barges.....	.2084	.1097
Maintenance of equipment.....	.1130	.0553
Plant arbitrary.....	.2209	.0649
Total.....	.5423	.2299



	Nombre de dias.	Chame.
Unloading:		
Operation cableways and cranes.....	. 1189	.0532
Power.....	.0188	.0284
Maintenance of equipment.....	.0782	.0596
Plant arbitrary.....	.1496	.1067
Total.....	.3655	.2482
Rail transportation to storage:		
Cubic yards transported.....	157,967	475,422
Operation of trains.....	\$0.0982	\$0.0462
Repairs to tracks.....	.0163	.0197
Dumping in storage.....	.0002	.0134
Maintenance of equipment.....	.0787	.0174
Plant arbitrary.....		.0849
Total.....	.1934	.1816
Total cost in storage.....	1.8565	.8284

It is noted that the cost of production by the Atlantic division has been greatly reduced since September, when an 18-inch pipe-line dredge was placed in operation at Nombre de Dios, for while the average cost in August was \$1.4034, with a production of 29,022 cubic yards, it fell to \$0.7251 in March, with a production of 47,885 cubic yards. The highest monthly cost since that dredge has been in service was in June, when 24,236 cubic yards were produced, at an average cost of \$0.8520 per cubic yard.

#### CONCRETE PILING.

A plant for the manufacture of concrete piling for use in the foundations of the middle approach wall of the Gatun locks began operation in March and to the close of the fiscal year 31,060 linear feet of piling had been manufactured, at an average division cost of \$1.2835 per linear foot. To June 30, 8,196 linear feet had been driven in the foundations, at an average division cost of \$2.2120 per linear foot.

#### POWER PLANT.

The power plant at Gatun generated 12,962,247 kilowatt hours, at an average division cost of \$0.0227; that at Miraflores, 6,797,714 kilowatt hours, at an average division cost of \$0.0274.

#### LIGHTING AND BUOYING CANAL.

This work was started in March, and to the close of the year 67,550 feet of surveys had been made, at an average cost of \$0.0282 per foot, and 37.35 acres cleared, at an average cost of \$24.4469 per acre.

#### HYDRAULIC FILLING IN CITY OF COLON.

The work of filling the city of Colon was begun in November, 1910, by the Atlantic division. This work consists of raising certain low portions of the city by means of a pipe-line suction dredge, and is to be paid for jointly by the Panama Railroad Co. and the commission on the basis of areas of building lots and streets, respectively.

The proportion of the commission is to be paid out of the special appropriation for municipal improvements in the cities of Panama and Colon. The quantities shown are based on borrow pit measurement, no allowance having been made for waste or consolidation. To June 30 there had been dredged 698,644 cubic yards, at an average cost of \$0.2108 per cubic yard. The cost of the fill in place will be considerably higher on account of quantities lost through waste and consolidation.

## EXHIBIT C.—PERFORMANCE SHEETS.

## ROCK CRUSHERS.

A comparison of the performance of the rock-crushing plants at Porto Bello and Ancon for the fiscal year is given in the following table:

	Porto Bello.	Ancon.
Hours in service.....	3,412.00	3,039.00
Hours at work.....	2,279.24	2,254.96
Number of cubic yards of stone produced.....	864,033.00	855,824.00
Average number of cubic yards per hour in service.....	253.23	281.61
Average number of cubic yards per hour at work.....	348.61	379.53
Per cent of working time to hours in service.....	72.66	74.20

At Porto Bello the quantities produced per hour in service and per hour at work varied largely under the different working time and conditions that obtained during the year:

	July and August, with-out large crusher, 16-hour day.	October to January, with large crusher, 12-hour day.	March to June, with large crusher, 8-hour day.
Hours in service.....	840.00	1,184.00	824.00
Hours at work.....	578.97	875.70	628.70
Cubic yards of stone produced.....	137,921.00	309,095.00	275,042.00
Average number of cubic yards per hour in service.....	164.19	261.06	333.79
Average number of cubic yards per hour at work.....	238.22	352.97	457.48
Per cent of working time to hours in service.....	68.92	73.96	76.30

At Ancon the quantities produced per hour in service and per hour at work during the 9 and 12 hour working day period was:

	July to November, and April to June, 9-hour day.	December to March, 12-hour day.
Hours in service.....	1,827.00	1,212.00
Hours at work.....	1,354.42	900.54
Number of cubic yards of stone produced.....	546,832.00	309,242.00
Average number of cubic yards per hour in service.....	299.17	255.15
Average number of cubic yards per hour working.....	403.55	343.40
Per cent of working time to hours in service.....	74.13	74.30

## UNLOADING PLANTS.

The Atlantic division plant for unloading stone and sand from barges consists of two duplex cableways, one single cableway, and a number of derricks, that of the Pacific division of three electric unloading cranes. A comparative table of the work performed follows:

	Atlantic division.		Pacific division.
	Cableway strands.	Derricks.	Electric cranes.
Average number operated.....	5.00	3.98	2.00
Total number of hours in service.....	35,117.00	22,998.00	4,857.43
Total number of hours at work.....	17,359.76	11,274.75	3,428.86
Cubic yards of material handled.....	742,408.00	461,271.00	494,841.00
Average number of cubic yards of material handled per hour in service.....	21.14	20.08	101.87
Average number of cubic yards of material handled per hour at work.....	42.77	40.91	144.32
Per cent of working time to hours in service.....	49.43	49.08	70.59

## MIXING PLANTS.

The mixing plants in the Atlantic division consist of a battery of eight 2-yard mixers, designated as the "Construction plant," and an auxiliary plant of two 2-yard mixers. The mixing plant of the Pacific division consists of four 2-yard mixers situated on two berm cranes, and a number of auxiliary mixers of different capacity, for which no performance sheets are available. The berm cranes were used at Pedro Miguel for a portion of the year and reerected at Miraflores when removed from the former point. A table of the work performed by these various plants follows:

	Atlantic division.		Pacific division.	
	Construction plant.	Auxiliary plant.	Berm cranes.	
			Pedro Miguel.	Miraflores.
Average number in use.....	6.08	2.00	3.08	3.59
Total hours in service.....	22,694.68	5,573.50	7,570.03	2,655.00
Total hours at work.....	13,330.25	3,312.57	5,394.19	1,632.79
Cubic yards concrete mixed.....	602,881.00	226,476.09	379,192.09	67,774.00
Average number of cubic yards of concrete mixed per hour in service.....	26.56	40.63	50.09	25.53
Average number of cubic yards of concrete mixed per hour at work.....	45.23	68.37	70.39	41.69
Per cent of working time to hours in service.....	58.74	59.43	71.26	62.25

## CONCRETE-PLACING PLANTS.

The plant of the Atlantic division for placing concrete consists of four duplex cableways—that of the Pacific division at Pedro Miguel of four chamber cranes. As auxiliaries to these plants, a number of derricks were used, performance of which was not tabulated. The work performed by the cableways at Gatun and the chamber cranes at Pedro Miguel is shown in the following table:

	Gatun.	Pedro Miguel.
	Cableway strands.	Cranes.
Average number operated.....	8.00	3.45
Total number of hours in service.....	29,614.98	9,238.12
Total number of hours handling concrete and large rock.....	19,003.03	6,230.02
Total number of hours handling steel and forms.....	2,606.96	
Cubic yards of concrete and large rock handled.....	616,661.00	401,725.00
Average number of cubic yards of concrete and large rock handled per hour in that work.....	32.45	64.71
Per cent of working time to hours in service.....	72.96	67.44

**EXHIBIT D.—COMPARATIVE STATEMENT OF ADMINISTRATIVE AND GENERAL EXPENSES.**

The total overhead expenses for the fiscal year 1911 were \$2,537,405.89; for the fiscal year 1910, \$2,655,498.25, a decrease of \$118,092.36. Included in the total for 1911 are the expenses for construction and repairs to buildings for the department of construction and engineering, \$15,229.53, which were charged to construction and repair of buildings under "General items" last year, so that the actual decrease has been \$133,321.89, or about 5 per cent. The principal items of increase are explained as follows: Clubhouses, \$8,869.43: Due to operation of Gatun, Porto Bello, and Corozal clubhouses, not operated during the year 1910; \$9,294.56, furniture and fixtures for new clubhouses at Gatun and Corozal; telegraph and telephones, \$21,416.39—increase in monthly payment to the Panama Railroad for this service, to absorb cost of rebuilding and improving the plant. This expense will be materially reduced during the next year, as the monthly payment will be reduced to actual operating cost whenever the balance remaining to the debit of the construction account has been settled. Purchasing expenses in the United States, \$24,540.06: Salaries and expenses of inspectors of lock gates, emergency dams, and lock-operating machinery. From July 1 these expenses and actual purchasing expenses will be shown separately. Operation of stores, \$78,940.69: Due to increased number of storehouses operated by the quartermaster's department. As the storehouses formerly under the division engineers were transferred to the chief quartermaster on January 1, 1910, only six months of these expenses were included in that year. A proportion of the expenses shown in 1910 under "Corrals," equipment and operation, is also included in this account in 1911. "Operation, docks and wharves, Isthmian Canal Commission and Panama Railroad," \$105,615.12; these items correspond to "Freight, advertising, and miscellaneous items" in 1910, \$96,867.62, compared with which there is an increase of \$8,747.50, due principally to increased amount of cement and gate material received.

The principal items of decrease are: Miscellaneous expenses in the United States, \$26,140.18; disbursing officer on Isthmus, \$2,014.91; examiner of accounts on Isthmus, \$5,113.31. These decreases are principally due to reductions of force. Transportation on Isthmus, passenger, \$8,761.62, reduction of monthly payment to Panama Railroad to estimated actual cost of service; hotel incidental ex-

penses, \$5,031.08, decrease in number of hotel messes and kitchens; recruiting, \$68,527.93—no laborers were recruited during the year and there was a decrease in number of employees recruited in the United States; quarters, \$62,601.12, due to reduction of force in the offices of the district quartermasters, of the number of janitors, and to consolidation of utility gangs; corrals, \$111,582.47—this represents the quartermaster's proportion of these expenses, which were this year absorbed in accounts "Operation storehouses" and "Quarters."

**EXHIBIT E.—STATEMENT OF SALARY DISBURSEMENTS BY DEPARTMENTS AND DIVISIONS.**

Congress appropriates separately for "Pay of officers and employees" and for "Skilled and unskilled labor." Expenditures for the year 1911 under these appropriations show that of a total disbursement of \$17,821,150.89, 21.32 per cent was for officers and employees and 78.68 per cent for skilled and unskilled labor. From the appropriation "Pay of officers and employees" are paid the salaries of the clerical and supervisory forces, so that the expenditures therefrom are in the nature of a surcharge to the productive salary expenditures represented by the disbursements from the appropriation for "Skilled and unskilled labor." For the Atlantic division this amounts to a surcharge of 26.05 per cent, for the central division 17.80 per cent, and for the Pacific division 22.95 per cent. The central division was engaged wholly in excavating in the dry during the year, while the work of the Atlantic and Pacific divisions was general in its character, so that no comparison can be made with first-named division. The similarity of the work in the last two named divisions allows of comparison, and the Pacific division appears to have been more economical by 3.10 per cent. Had the percentage of payments for supervisory forces been the same in that division as in the Atlantic division, its total salary disbursements would have been increased \$73,847.40; and had the percentage of payment for supervisory forces been the same in the Atlantic division as in the Pacific division, its total salary disbursements would have been decreased \$125,949.41.

**EXHIBIT F.—CONSTRUCTION PANAMA RAILROAD LUMBER DOCK AT BALBOA.**

The Pacific division is constructing a dock for the Panama Railroad at Balboa, the cost of which is to be reimbursed the commission by that company. To the close of the fiscal year, the quantities of work done and the costs were as follows: Dredging channel to dock, 705,465 cubic yards, average cost \$0.1268 per cubic yard; excavation for piers 4,069 cubic yards, average cost \$3.3621 per cubic yard; concrete substructure 558 cubic yards, average cost \$62.2045 per cubic yard. This latter item includes the cost of sufficient reenforcing material to place 10,000 cubic yards of concrete. By charging only the percentage of this expense that the yardage laid bears to 10,000 cubic yards, gives an average cost for the work accomplished of \$28.5246 per cubic yard. The cost of plant and equipment is not included in these figures, it being held in suspense until such time as the quan-

tity of work to be done on the terminals that will be built by the commission is ascertained.

There are attached hereto the following exhibits:

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Respectfully submitted.

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**EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911.**

TABLE 1.—Statement of construction expenditures to June 30, 1911.

## ATLANTIC DIVISION.

	Quantity.	Total division ex- penses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
<b>Dry excavation—Prism:</b>							
May 4, 1904, to June	<i>Cubic yds.</i>						
30, 1909.....	1,152,106	\$678,330.97	\$0.5844	\$168,017.26	\$0.0686	\$775,348.23	\$0.6730
Fiscal year 1910.....	324,718	201,916.36	.6218	24,988.55	.0770	226,904.91	.6988
Fiscal year 1911.....	280,305	168,440.60	.6010	18,948.79	.0697	182,389.39	.6607
<b>Total, June 30, 1911.</b>	1,757,126	1,043,687.93	.5940	140,944.60	.0802	1,184,632.53	.6742
<b>Plant:</b>							
Amount to be ab-							
sorbed after June							
30, 1911.....		15,847.61				15,847.61	
<b>Total.....</b>		1,059,535.54		140,944.60		1,200,480.14	
<b>Hydraulic excavation—</b>							
<b>Prism:</b>							
Total, fiscal year, 1911.	28,606	7,721.28	.2700	1,143.60	.0400	8,864.87	.3090
<b>Dredging excavation—</b>							
<b>Prism:</b>							
May 4, 1904, to June							
30, 1909.....	13,188,123	2,654,951.70	.2013	273,423.93	.0207	2,928,375.63	.2220
Fiscal year 1910.....	4,955,660	1,169,667.60	.2360	131,370.17	.0265	1,301,037.77	.2625
Fiscal year 1911.....	5,828,345	1,291,257.03	.2215	126,902.86	.0218	1,418,159.89	.2433
<b>Total, June 30, 1911.</b>	23,972,128	5,115,876.33	.2134	531,696.95	.0232	5,647,573.28	.2356

## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1911—Continued.

## ATLANTIC DIVISION—Continued.

	Quantity.	Total division ex- penses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
<b>Plant:</b>							
Amount to be ab- sorbed after June 30, 1911.....	<i>Cubic yds.</i>	\$662,660.98				\$662,660.98	
<b>Total.....</b>		5,778,537.31		\$531,698.45		6,310,235.76	
<b>GATUN SPILLWAY.</b>							
<b>Dry excavation:</b>							
May 4, 1904, to June 30, 1909.....	1,296,332	778,514.20	\$0.6006	127,355.38	\$0.0982	905,869.58	\$0.6988
Fiscal year 1910.....	123,487	117,945.47	.9629	15,460.31	.1262	133,405.78	1.0891
Fiscal year 1911.....	125,383	51,014.86	.4069	5,890.34	.0470	56,905.23	.4539
<b>Total, June 30, 1911.</b>	1,544,202	947,474.56	.6136	148,706.03	.0963	1,096,180.59	.7099
<b>Preparing foundations:</b>							
Fiscal year 1910.....	4,723	18,632.78	3.9451	2,732.07	.5785	21,364.85	4.5236
Fiscal year 1911.....	32,245	48,521.10	1.5048	5,893.94	.1828	54,415.04	1.6876
<b>Total, June 30, 1911.</b>	36,968	67,153.88	1.8166	8,626.01	.2333	75,779.89	2.0499
<b>Masonry:</b>							
May 4, 1904, to June 30, 1909.....	30,464	223,203.73	7.3268	20,565.26	.6751	243,768.99	8.0019
Fiscal year 1910.....	53,632	461,338.27	8.6019	27,390.14	.5105	488,718.41	9.1124
Fiscal year 1911.....	59,651	399,925.98	6.7044	16,875.75	.2829	416,801.73	6.9873
<b>Total, June 30, 1911.</b>	143,747	1,084,467.98	7.5443	64,821.15	.4509	1,149,289.13	7.9852
<b>Ironwork:</b>							
Fiscal year 1910.....		346.26		41.60		387.86	
Fiscal year 1911.....		16,869.54		2,573.79		19,443.33	
<b>Total, June 30, 1911.</b>		17,215.80		2,615.39		19,831.19	
<b>Back filling:</b>							
Fiscal year 1910.....	1,781	1,005.69	.5647	93.55	.0525	1,099.24	.6172
Fiscal year 1911.....	12,873	6,220.54	.4832	773.45	.0601	6,993.99	.5433
<b>Total, June 30, 1911.</b>	14,654	7,226.23	.4931	867.00	.0592	8,093.23	.5523
<b>Total, Gatun spill- way.....</b>		2,128,538.45		225,635.58		2,349,174.03	
<b>GATUN DAM.</b>							
<b>Dredging excavation:</b>							
Total, May 4, 1904, to June 30, 1909.....	38,425	18,322.71	.4769	1,718.48	.0447	20,041.19	.5216
<b>Dry filling:</b>							
May 4, 1904, to June 30, 1909.....	2,244,622	927,319.57	.4131	181,339.46	.0808	1,108,659.03	.4939
Fiscal year 1910.....	2,555,197	757,828.15	.2966	87,078.24	.0340	844,906.39	.3306
Fiscal year 1911.....	2,663,908	1,011,978.51	.3813	75,967.00	.0286	1,087,945.51	.4099
<b>Total, June 30, 1911.</b>	7,463,727	2,697,126.23	.3619	344,384.70	.0462	3,041,510.93	.4081
<b>Hydraulic filling:</b>							
May 4, 1904, to June 30, 1909.....	720,047	162,553.19	.2258	34,540.85	.0479	197,094.04	.2737
Fiscal year 1910.....	2,933,175	786,641.96	.2682	59,910.57	.0204	846,552.53	.2886
Fiscal year 1911.....	4,256,393	974,230.44	.2289	77,572.23	.0182	1,051,802.67	.2471
<b>Total, June 30, 1911.</b>	7,909,615	1,923,425.59	.2432	172,023.65	.0217	2,095,449.24	.2649



## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1911—Continued.

## ATLANTIC DIVISION—Continued.

	Quantity.	Total division ex- penses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN DAM—continued.							
Paving:	<i>Cubic yds.</i>						
Fiscal year 1910.....	22,037	\$6,372.92	\$0.2892	\$415.58	\$0.0189	\$6,788.50	\$0.3081
Fiscal year 1911.....	18,374	7,111.63	.3871	819.56	.0446	7,931.19	.4317
Total, June 30, 1911.	40,411	13,484.55	.3337	1,235.14	.0305	14,719.69	.3642
Total, Gatun Dam		4,652,359.08		519,361.97		5,171,721.05	
Total, Gatun Dam and spillway		6,775,897.53		744,997.55		7,520,895.08	
Plant:							
Amount to be ab- sorbed after June 30, 1911.....		309,232.17				309,232.17	
Total.....		7,085,129.70		744,997.55		7,830,127.25	
GATUN LOCKS.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	3,240,218	1,729,279.35	.5337	217,726.78	.0672	1,947,006.13	.6009
Fiscal year 1910.....	839,302	687,602.40	.8193	73,991.47	.0881	761,593.87	.9074
Fiscal year 1911.....	475,875	338,332.43	.7110	37,019.15	.0778	375,351.58	.7888
Total, June 30, 1911.	4,555,395	2,755,214.18	.6048	328,737.40	.0722	3,083,951.58	.6770
Dredging excavation:							
May 4, 1904, to June 30, 1909.....	488,533	79,978.65	.1637	9,427.51	.0193	89,406.16	.1830
Fiscal year 1910.....		2,999.32		305.94		3,305.26	
Fiscal year 1911.....							
Total, June 30, 1911.	488,533	82,977.97	.1699	9,733.45	.0199	92,711.42	.1898
Preparing foundations:							
Excavation—							
Fiscal year 1910....	33,843	85,109.77	2.5148	13,392.73	.3957	98,502.50	2.9105
Fiscal year 1911....	152,582	237,098.48	1.5540	27,640.92	.1811	264,739.40	1.7351
Total, June 30, 1911.....	186,425	322,208.25	1.7284	41,033.65	.2201	363,241.90	1.9485
Filling—							
Fiscal year 1910....	17,883	10,607.43	.5932			10,607.43	.5932
Fiscal year 1911....	22,234	4,239.79	.1907	379.51	.0171	4,619.30	.2078
Total, June 30, 1911.....	40,117	14,847.22	.3701	379.51	.0095	15,226.73	.3796
Concrete piling, total, fiscal year 1911.....	18,196	18,129.46	2.2120	635.29	.0775	18,764.75	2.2895
Masonry:							
Concrete masonry—							
May 4, 1904, to June 30, 1909.....		15,098.59		2,054.67		17,153.26	
Fiscal year 1910.....	513,803	3,779,163.81	7.3553	204,596.95	.3982	3,983,760.76	7.7535
Fiscal year 1911....	902,926	5,952,008.08	6.5919	199,380.61	.2208	6,151,388.69	6.8127
Total, June 30, 1911.....	1,416,729	9,746,260.48	6.8794	406,032.23	.2866	10,152,292.71	7.1066
Concrete, reinforced, total, fiscal year 1911.....	8,211	102,216.13	12.4487	9,261.28	1.1279	111,477.41	13.5766
Total, masonry.	1,424,940	9,848,476.61	6.9115	415,293.51	.2914	10,263,770.12	7.2029
Ironwork:							
Fiscal year 1910.....		226,554.37		26,112.31		252,666.68	
Fiscal year 1911.....		634,393.83		93,801.95		728,195.78	
Total, June 30, 1911.		860,948.20		119,914.26		980,862.46	

1 Linear feet.

## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1911—Continued.

## ATLANTIC DIVISION—Continued.

	Quantity.	Total division expenses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN LOCKS—CON.							
Back filling:	<i>Cubic yds.</i>						
Fiscal year 1910.....	4,190	\$4,811.52	\$1.1483	\$388.29	\$0.0927	\$5,199.81	\$1.2410
Fiscal year 1911.....	535,669	284,221.51	.5307	29,446.89	.0549	313,668.40	.5856
Total, June 30, 1911.....	539,859	289,033.03	.5354	29,835.18	.0552	318,868.21	.5906
Filling center wall, fiscal year 1911 total.....	2,717	2,889.16	1.0634	212.09	.0780	3,101.25	1.1414
Total, Gatun locks.....		14,194,724.08		945,774.34		15,140,498.42	
Plant:							
Amount to be absorbed after June 30, 1911.....		714,237.44				714,237.44	
Total.....		14,908,961.52		945,774.34		15,854,735.86	
GATUN-MINDI LEVEE.							
Dry filling:							
Fiscal year 1910.....	126,002	51,789.04	.4110	6,125.69	.0486	57,914.73	.4596
Fiscal year 1911.....	51,156	10,128.74	.1979	941.68	.0184	11,070.42	.2163
Total, June 30, 1911.....	177,158	61,917.78	.3495	7,067.37	.0399	68,985.15	.3894
Hydraulic filling, total, fiscal year 1911.....	20,396	3,326.91	.1631	156.41	.0077	3,483.32	.1708
Total, Gatun-Mindi levee.....		65,244.69		7,223.78		72,468.47	
Colon breakwater:							
May 4, 1904, to June 30, 1909.....		7,436.72				7,436.72	
Fiscal year 1910.....		43,773.31		4,910.83		48,684.14	
Fiscal year 1911.....	359,890	522,084.39	1.4506	87,177.40	.2423	609,261.79	1.6929
Total, June 30, 1911.....	359,890	573,294.42	1.5930	92,088.23	.2558	665,382.65	1.8488
Plant:							
Amount to be absorbed after June 30, 1911.....		667,431.21				667,431.21	
Total, Colon breakwater.....		1,240,725.63		92,088.23		1,332,813.86	
Manufacturing plant:							
Amounts to be absorbed in cost of products after June 30, 1911—							
Porto Bello quarry.....		468,846.65				468,846.65	
Nombre de Dios sand plant.....		143,132.04				143,132.04	
Sea transportation plant.....		638,663.36				638,663.36	
Total.....		1,250,642.05				1,250,642.05	
Total, Atlantic division.....		31,396,497.72		2,463,875.44		33,860,373.16	

## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 2.—Statement of construction expenditures to June 30, 1911—Continued.

## CENTRAL DIVISION.

	Quantities.	Total division expenses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dry excavation—							
Prism:							
May 4, 1904, to	<i>Cubic yards.</i>						
June 30, 1909.....	40,983,306	\$37,540,874.34	\$0.9160	\$4,615,073.19	\$0.1126	\$42,155,947.53	\$1.0286
Fiscal year 1910....	17,832,177	11,945,261.93	.6699	1,152,810.58	.0646	13,098,072.51	.7345
Fiscal year 1911....	18,522,092	10,891,360.70	.5880	847,225.78	.0457	11,738,586.48	.6337
Total, June 30, 1911.....	77,338,235	60,377,496.97	.7807	6,615,109.55	.0855	66,992,606.52	.8662
Dredging excavation—							
Prism:							
Total, May 4, 1904, to June 30, 1909.....		8,067.72		1,730.68		9,798.40	
Clearing canal line:							
Fiscal year 1910....	<sup>1</sup> 2,098	134,857.24	64.2789			134,857.24	64.2789
Fiscal year 1911....	<sup>1</sup> 182	3,991.79	21.9329	467.38	2.5680	4,459.17	24.5009
Total, June 30, 1911.....	<sup>1</sup> 2,280	138,849.03	60.8987	467.38	.2050	139,316.41	61.1037
Masonry:							
Total, fiscal year 1911.....	1,020	5,639.35	5.5288	585.09	.5736	6,224.44	6.1024
Plant:							
Amount to be absorbed after June 30, 1911.....		790,169.02				790,169.02	
Total, Central division.....		61,320,222.09		6,617,892.70		67,938,114.79	

<sup>1</sup> Acres.

TABLE 3.—Statement of construction expenditures to June 30, 1911.

## PACIFIC DIVISION.

	Quantities.	Total division expenses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dry excavation—							
Prism:							
May 4, 1904, to	<i>Cubic yards.</i>						
June 30, 1909.....	139,470	\$119,747.16	\$0.8586	\$21,514.28	\$0.1542	\$141,261.44	\$1.0128
Fiscal year 1910....	99,703	63,266.48	.6345	6,622.63	.0664	69,889.11	.7009
Fiscal year 1911....	198,770	138,349.00	.6960	12,662.38	.0637	151,011.38	.7597
Total, June 30, 1911.....	437,943	321,362.64	.7338	40,799.29	.0932	362,161.93	.8270
Plant:							
Amount to be absorbed after June 30, 1911.....		318,046.45				318,046.45	
Total.....		639,409.09		40,799.29		680,208.38	
Hydraulic excavation—							
Prism:							
Total, fiscal year 1911.....	197,677	120,714.14	.6106	9,088.12	.0460	129,802.26	.6566

## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1911—Continued.

## PACIFIC DIVISION—Continued.

	Quantities.	Total division expenses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
<b>Plant:</b>							
Amount to be absorbed after June 30, 1911....	Cubic yds.	\$367,008.83	.....	.....	.....	\$367,008.83	.....
Total.....		487,812.97	.....	\$9,088.12	.....	496,901.09	.....
<b>Dredging excavation—Prism:<sup>1</sup></b>							
May 4, 1904, to June 30, 1909....	16,180,107	3,427,748.61	\$0.2118	277,360.96	\$0.0172	3,705,109.57	\$0.2290
Fiscal year 1910....	6,857,223	1,650,894.38	.2408	156,092.09	.0227	1,806,986.47	.2635
Fiscal year 1911....	5,549,642	1,398,087.35	.2519	136,071.78	.0245	1,534,159.13	.2764
Total, June 30, 1911.....	28,586,972	6,476,730.34	.2266	569,524.83	.0199	7,046,255.17	.2465
<b>PEDRO MIGUEL DAM.</b>							
<b>Dry excavation:</b>							
May 4, 1904, to June 30, 1909....	4,074	5,241.81	1.2866	.....	.....	5,241.81	1.2866
Fiscal year 1910....	.....	925.47	.....	.....	.....	925.47	.....
Total, June 30, 1911.....	4,074	6,167.28	1.5138	.....	.....	6,167.28	1.5138
<b>Dry filling:</b>							
May 4, 1904, to June 30, 1909....	167,061	71,275.77	.4266	9,985.14	.0598	81,260.91	.4864
Fiscal year 1910....	93,791	36,205.63	.3860	3,892.31	.0415	40,097.94	.4275
Fiscal year 1911....	.....	4,058.42	.....	584.55	.....	4,642.97	.....
Total, June 30, 1911.....	260,852	111,539.82	.4276	14,462.00	.0554	126,001.82	.4830
Total, Pedro Miguel Dam....	.....	117,707.10	.....	14,462.00	.....	132,169.10	.....
<b>PEDRO MIGUEL LOCKS.</b>							
<b>Dry excavation:</b>							
May 4, 1904, to June 30, 1909....	720,157	508,834.12	.7066	76,019.61	.1055	584,853.73	.8121
Fiscal year 1910....	298,500	354,524.81	1.1876	48,521.87	.1626	403,046.68	1.3502
Fiscal year 1911....	16,423	9,838.84	.5991	966.86	.0589	10,805.70	.6560
Total, June 30, 1911.....	1,035,080	873,197.77	.8436	125,508.34	.1213	998,706.11	.9649
<b>Preparing foundations:</b>							
Fiscal year 1910....	44,948	126,722.55	2.8193	14,916.60	.3319	141,639.15	3.1512
Fiscal year 1911....	76,847	182,477.38	2.3746	22,073.06	.2872	204,550.44	2.6618
Total, June 30, 1911.....	121,795	309,199.93	2.5387	36,989.66	.3037	346,189.59	2.8424
<b>Masonry:</b>							
<b>Concrete masonry—</b>							
Fiscal year 1910.....	166,869	1,016,107.42	6.0892	86,704.98	.5196	1,102,812.40	6.6088
Fiscal year 1911.....	497,802	2,341,652.75	4.7040	138,716.42	.2787	2,480,369.17	4.9827
Total, June 30, 1910....	664,671	3,357,760.17	5.0518	225,421.40	.3391	3,583,181.57	5.3909

<sup>1</sup> The total cost of dredging-excavation plant was absorbed with the charges for the month of April owing to the fact that the estimated yardage to be accomplished was too small. Hence no charge for plant arbitrary appears after that date.

## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1911—Continued.

## PACIFIC DIVISION—Continued.

	Quantities.	Total division expenses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
<b>PEDRO MIGUEL LOCKS—continued.</b>							
Masonry—Continued.							
Concrete, reinforced—							
Total, fiscal year 1911...	Cubic yds. 385	\$6,830.91	\$17.7426	\$773.16	\$2.0082	\$7,604.07	\$19.7508
Total, masonry.....	665,056	3,364,591.08	5.0591	226,194.56	.3401	3,590,785.64	5.3992
Ironwork:							
May 4, 1904, to June 30, 1909.....		108,843.27		8,190.96		117,034.23	
Fiscal year 1910.....		143,491.61		3,634.93		147,126.54	
Fiscal year 1911.....		233,496.82		21,544.57		255,041.39	
Total, June 30, 1911.....		485,831.60		33,370.46		519,202.06	
Backfilling:							
Fiscal year 1910.....	9,616	2,737.77	.2847	278.81	.0290	3,016.58	.3137
Fiscal year 1911.....	273,709	106,753.75	.3900	8,619.21	.0315	115,372.96	.4215
Total, June 30, 1911.....	283,325	109,491.52	.3865	8,898.02	.0314	118,389.54	.4179
Total, Pedro Miguel locks.....		5,142,310.90		431,161.04		5,573,471.94	
Total, Pedro Miguel locks and dams.....		5,260,018.00		445,623.04		5,705,641.04	
Plant:							
Amount to be absorbed after June 30, 1911.....		282,047.16				282,047.16	
Total.....		5,542,065.16		445,623.04		5,987,688.20	
<b>MIRAFLORES DAM AND SPILLWAY.</b>							
Miraflores Dam:							
Dry excavation—							
May 4, 1904, to June 30, 1909.....	13,986	19,681.84	1.4073			19,681.84	1.4073
Fiscal year 1910.....	550	299.74	.5450	9.68	.0176	309.42	.5626
Total, June 30, 1911.....	14,536	19,981.58	1.3746	9.68	.0007	19,991.26	1.3753
Masonry, core wall—Total, fiscal year 1910.....		388.59		40.92		429.51	
Dry filling—							
May 4, 1904, to June 30, 1909.....	363,418	172,058.40	.4694	22,311.58	.0654	194,369.98	.5348
Fiscal year 1910.....	157,483	106,686.04	.6774	12,828.58	.0815	119,514.62	.7589
Fiscal year 1911.....	295,598	121,266.20	.4102	8,806.63	.0298	130,072.83	.4400
Total, June 30, 1911.....	816,499	400,000.64	.4899	43,946.79	.0688	443,947.43	.5437

## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1911—Continued.

## PACIFIC DIVISION—Continued.

	Quantities.	Total division expenses, including arbitrates.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
<b>MIRAFLORES DAM AND SPILLWAY—Contd.</b>							
Miraflores Dam—Con.							
Hydraulic filling—							
Fiscal year 1910	Cubic yds.	\$3,665.16		\$412.70		\$4,077.86	
Fiscal year 1911		16,674.85		1,987.59		18,662.44	
Total, June 30, 1911		20,340.01		2,400.29		22,740.30	
Total, Miraflores dam and spillway		440,710.82		46,397.68		487,108.50	
<b>MIRAFLORES LOCKS.</b>							
Dry excavation:							
Diversions—							
Total, fiscal year 1910	5,885	2,028.98	\$0.3448			2,028.98	\$0.3448
In lock site—							
May 4, 1904, to June 30, 1909	1,120,342	910,973.87	.8131	164,599.98	\$0.1469	1,075,573.85	.9600
Fiscal year 1910	229,793	303,825.88	1.3222	42,925.57	.1868	346,751.45	1.5090
Fiscal year 1911	247,700	182,758.81	.7378	17,645.43	.0712	200,404.24	.8090
Total, June 30, 1911	1,597,835	1,397,558.56	.8747	225,170.98	.1409	1,622,729.54	1.0156
Dredging excavation:							
May 4, 1904, to June 30, 1909	167,888	57,408.31	.3418	6,587.95	.0393	63,996.26	.3811
Fiscal year 1910	141,759	71,784.25	.5063	6,599.15	.0466	78,383.40	.5529
Total, June 30, 1911	309,647	129,192.56	.4172	13,187.10	.0426	142,379.66	.4598
Hydraulic excavation: Total, fiscal year 1911	332,703	182,526.79	.5486	12,772.23	.0384	195,299.02	.5870
Preparing foundations:							
Fiscal year 1910	64,036	124,669.74	1.9469	15,952.08	.2491	140,621.82	2.1960
Fiscal year 1911	137,762	221,569.09	1.6085	27,351.86	.1985	248,920.95	1.8070
Total, June 30, 1911	201,788	346,238.83	1.7159	43,303.94	.2146	389,542.77	1.9305
Masonry:							
Fiscal year 1910	1,630	12,050.56	7.3929	1,173.62	.7200	13,224.18	8.1129
Fiscal year 1911	272,933	1,278,048.03	4.6826	86,998.07	.3151	1,364,046.10	4.9977
Total, June 30, 1911	274,563	1,290,098.59	4.6987	87,171.69	.3175	1,377,270.28	5.0162
Ironwork:							
Fiscal year 1910		92,950.46		2,490.41		95,440.87	
Fiscal year 1911		413,153.74		34,433.35		447,587.09	
Total, June 30, 1911		506,104.20		36,923.76		543,027.96	

## EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1911—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1911—Continued.

## PACIFIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
<b>MIRAFLORES LOCKS— continued.</b>							
Back filling:							
May 4, 1904, to June 30, 1909.....	<i>Cubic yds.</i> 409,211	\$36,801.83	\$0.0899	\$6,246.87	\$0.0153	\$43,048.70	\$0.1052
Fiscal year 1910.....	121,080	52,170.32	.4309	6,741.18	.0557	58,911.50	.4866
Fiscal year 1911.....	53,521	22,976.42	.4293	2,557.17	.0478	25,533.59	.4771
Total, June 30, 1911.....	583,812	111,948.57	.1918	15,545.22	.0266	127,493.79	.2184
Total, Mira- flores locks.....		3,965,697.08		434,074.92		4,399,772.00	
Total, Mira- flores locks and dams.....		4,406,407.90		480,472.60		4,886,880.50	
<b>LA BOCA LOCKS AND DAMS.<sup>1</sup></b>							
Dry excavation: Tot- al, May 4, 1909, to June 30, 1909.....	78,233	131,254.40	1.6777	27,088.89	.3463	158,343.29	2.0240
Construction:							
Dam—May 4, 1904, to June 30, 1909.....		288,601.56		26,748.51		315,350.07	
Locks—May 4, 1904, to June 30, 1909.....		145,828.37		13,478.03		159,306.40	
Total, La Boca locks and dams.....		565,684.33		67,315.43		632,999.76	
Total lower locks and dams, Pacific entrance.....		4,972,092.23		547,788.03		5,519,880.26	
<b>Plant:</b>							
Amount to be ab- sorbed after June 30, 1911.....		792,703.60				792,703.60	
Total.....		5,764,795.83		547,788.03		6,312,583.86	
<b>NAOS ISLAND BREAK- WATER.<sup>2</sup></b>							
Fiscal year 1910.....		36,847.73		20.03		36,867.76	
Fiscal year 1911.....		21,238.30				21,238.30	
Total, June 30, 1911.....		58,086.03		20.03		58,106.06	
<b>MANUFACTURING AND CONSTRUCTION PLANTS.</b>							
Amounts to be ab- sorbed after June 30, 1911:							
Rock construc- tion plant.....		34,046.49				34,046.49	
Electric power plant.....		393,840.47				393,840.47	
Ancient rock quarry.....		440,112.99				440,112.99	
Chame sand plant		137,899.12				137,899.12	
Total.....		1,005,899.07				1,005,899.07	
Total Pacific division.....		19,974,798.49		1,612,843.34		21,587,641.83	
Total construc- tion cost.....		112,691,518.30		10,694,611.48		123,386,129.78	

<sup>1</sup> Subsequently abandoned owing to change of plans.<sup>2</sup> Construction by central division. Charges represent cost of trestling only, as that is considered the extra cost due to disposition of spoil at this point.

## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911.

TABLE 1.—*Dry excavation.*

## ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>FRIS.</b>													
Dry excavation..... cubic yards.....								41,902	49,734	74,030	58,962	55,657	280,306
Drilling.....								\$0.0123	\$0.0304	\$0.0337	\$0.0448	\$0.0408	\$0.0337
Blasting.....								.0066	.0239	.1057	.0652	.0652	.0404
Loading by power.....								.0804	.0745	.0649	.0717	.0801	.0679
Trucks.....								.0873	.1633	.0580	.0459	.0463	.0805
Transportation.....								.0608	.1103	.0689	.1572	.1046	.1209
Clearing site.....								.0335	.0349	.0744	.0460	.0659	.0013
Pumps.....								.0644	.0879	.0411	.0595	.0648	.0323
Maintenance of equipment.....								.1190	.1190	.1190	.1190	.1190	.0648
Plant arbitrary.....								.0118	.0157	.0147	.0188	.0202	.0202
Division expense.....								.4591	.6569	.4636	.6121	.6151	.6010
Total division cost.....								.0372	.0464	.0411	.0595	.0366	.0497
Administrative and general expense.....								.4963	.7033	.5047	.6716	.6517	.6507
Total cost.....													
<b>GATUN SPILLWAY.</b>													
Dry excavation..... cubic yards.....	15,436	10,506	22,662	31,010	28,361	17,406							125,383
Drilling.....			\$0.0004	\$0.0057	\$0.0216	\$0.0395							\$0.0119
Blasting.....			.0106	.0108	.0478	.0716							.0253
Loading by power.....			.0747	.0564	.0906	.1204							.0762
Trucks.....	\$0.0586	\$0.0518	.0644	.0294	.0420	.0719							.0503
Transportation.....	.0100	.1273	.0644	.0363	.0673	.0810							.0588
Trestles.....	.0643	.0427	.0654	.0363	.0673	.0810							.0006
Maintenance of equipment.....	.0497	.0227	.0583	.0459	.0610	.0528							.0512
Plant arbitrary.....	.1100	.1100	.1100	.1100	.1100	.1100							.1100
Division expense.....	.0206	.0308	.0228	.0139	.0253	.0302							.0226
Total division cost.....	.3132	.3853	.4109	.3084	.4656	.5774							.4069
Administrative and general expense.....	.0627	.0297	.0482	.0275	.0567	.0607							.0470
Total cost.....	.3759	.4150	.4591	.3359	.5223	.6381							.4539



## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 1.—Dry excavation—Continued.

## ATLANTIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Preparing foundations, excavation, cubic yards.....	3,614	1,973	2,800	3,870	1,635	1,082	5,636	6,881	1,010	1,778	2,051	115	32,245
Drilling.....							\$0.1199	\$0.0575		\$0.3777			\$0.0375
Blasting.....							.0632	.0462		.0301			.0226
Loading by power.....				\$0.0141		\$0.0232	.0616	.1479	1.90.1996	1.2740	\$0.2182	\$0.0983	.0409
Loading by hand.....	\$0.0086	\$0.7439	\$0.4556	.4604	\$0.6284	.9256	.5274	.6129	2.0237	.4310	1.2783	11.8028	.7015
Transportation.....				.0061		.2712	.2914	.3210	.2085	.0195	.0213	.2678	.1269
Tracks (trestles).....		.0240					.0845	.0645		.0435	.0206		.0744
Confederates.....							.3848	.3848	.9179	.2376	.6061	6.8043	.1822
Pumps (power).....	.0215		.0023	.0159		.0865	.0196	.0445	.0094	.0555	.0042		.0132
Maintenance of equipment.....	.1100	.1100	.1100	.1100	.1100	.1100	.1751	.1920	.0684	.0367	.2081	.9987	.0962
Plant arbitrary.....	.0892	.1009	.0548	.0571	.0601	.0786	.1068	.1190	.0609	.1190	.1538	1.0020	.1149
Division expense.....										.0619			.0915
Total division cost.....	.8293	.9788	.6277	.6636	.7685	1.1739	1.7552	2.0681	3.2190	.7818	2.6306	21.4179	1.8046
Administrative and general expense.....	.1094	.1226	.0825	.0751	.1063	.1466	.2115	.2465	.2087	.1189	.4186	2.7043	.1828
Total cost.....	.9387	1.1014	.7052	.7387	.9048	1.3205	1.9667	2.3146	3.4266	.9007	3.0412	24.1222	1.9876
GATUN LOCKS.													
Dry excavation.....cubic yards..	70,503	76,681	70,348	77,332	59,796	40,087	47,988	33,180					475,875
Drilling.....	\$0.0288	\$0.0224	\$0.0215	\$0.0297	\$0.0449	\$0.0435	\$0.0419	\$0.0359					\$0.0286
Blasting.....	.0498	.0322	.0392	.0424	.0531	.0824	.0407	.0511					.0419
Loading by power.....	.1002	.0846	.0775	.0760	.1032	.1281	.0942	.1073					.0858
Tracks.....	.1644	.1418	.0949	.0946	.0968	.1198	.0918	.0817					.1120
Transportation.....	.1586	.1445	.1351	.1249	.1640	.2068	.1889	.1314					.1497
Trestles.....						.0398	.0330	.0193					.0380
Pumps.....	.0312	.0465	.0289	.0320	.0253	.0386	.0410	.0583					.0345
Power.....	.0103	.0360	.0085	.0119	.0194	.0293	.0166	.0069					.0128
Maintenance of equipment.....	.0966	.0860	.0946	.1531	.0845	.0984	.0854	.1125					.0981
Plant arbitrary.....	.1100	.1100	.1100	.1100	.1100	.1100	.1190	.1190					.1115
Division expense.....	.0524	.0501	.0269	.0446	.0399	.0421	.0334	.0194					.0403
Total division cost.....	.7961	.8779	.6418	.7192	.7461	.8776	.7059	.6507					.7110
Administrative and general expense.....	.0842	.0820	.0658	.0789	.0930	.0818	.0967	.0572					.0778
Total cost.....	.8803	.7599	.7076	.7981	.8411	.9594	.7726	.7079					.7888

Preparing foundations, excavation, cubic yards.....	5,820	10,575	7,530	6,115	4,770	13,455	12,265	10,480	38,946	23,186	14,685	4,725	152,562
Drilling.....	\$0.3490	\$0.1401	\$0.1945	\$0.1065	\$0.3103	\$0.1000	\$0.2317	\$0.4237	\$0.0624	\$0.1100	\$0.1210	\$0.2062	\$0.1670
Blasting.....	1712	2602	1267	0603	0173	0038	1186	2180	0635	0653	0089	2806	1009
Loading by power.....	1396	1253	2066	1602	1602	1224	0776	1630	1039	1048	1301	1016	1016
Leading by hand.....	1,1666	5566	8112	3713	3024	3796	3463	2637	1970	2600	2673	9065	8762
Transportation.....	2059	1151	0607	2467	1763	0661	0946	0246	1906	1833	3166	3466	3166
Trucks (trestles).....	.....	0196	0259	0004	.....	.....	.....	1901	0500	1325	2480	0085	0728
Pumps (power).....	.....	0021	.....	.....	.....	.....	.....	0811	0500	1259	1178	0085	0728
Maintenance of equipment.....	1549	1050	1747	3785	2527	5630	1465	1849	2003	1940	1299	2902	5264
Plant arbitrary.....	1100	1100	1100	1100	1100	1100	1100	1880	2003	1940	1190	2902	5264
Division expense.....	2749	1415	1844	1096	0648	0623	0788	0788	1190	1190	1190	1190	1190
Total division cost.....	2,5601	1,5875	1,8508	1,6649	1,4070	1,4662	1,3715	1,8528	1,1378	1,5400	1,7773	2,4721	1,5540
Administrative and general expense.....	4223	2260	2602	1509	2055	1862	1862	2287	0913	1842	2061	2608	1811
Total cost.....	2,9914	1,8125	2,1200	1,8358	1,6126	1,6524	1,5598	2,0826	1,2291	1,7451	1,9834	2,7329	1,7861

## CENTRAL DIVISION.

Cubic yards.....	1,310,620	1,607,582	1,574,238	1,587,803	1,465,536	1,386,049	1,594,955	1,621,392	2,000,631	1,485,089	1,300,463	1,401,016	18,344,424
Clearing site.....	\$0.0001	\$0.0484	\$0.0480	\$0.0523	\$0.0466	\$0.0555	\$0.0476	\$0.0474	\$0.0408	\$0.0492	\$0.0586	\$0.0554	\$0.0000
Drilling.....	0629	0670	0455	0381	0460	0535	0552	0472	0601	0870	0792	0676	0603
Blasting.....	0751	0670	0453	0469	0462	0629	0480	0461	0411	0636	0569	0421	0547
Loading by power.....	0629	1139	0994	1151	1216	1442	1206	0626	0702	0773	0653	0621	0468
Trucks.....	1262	0706	0792	0689	1032	1005	0754	0701	0966	0637	0883	0621	1014
Transportation.....	0625	0599	0582	0578	0536	0471	0434	0468	0331	0437	0449	0440	0616
Pumps.....	0625	0025	0007	1,0006	0017	0029	0062	0065	0032	0056	0033	0042	0088
Maintenance of equipment.....	0636	0839	0918	0887	0728	0860	0882	0637	0960	0901	1080	1011	0676
Plant.....	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Division expense.....	0165	0128	0136	0133	0154	0137	0119	0121	0105	0100	0117	0112	0128
Total division cost.....	7217	5910	5856	6053	6101	6593	5984	5354	4786	5621	6322	5714	5902
Administrative and general expense.....	0446	0407	0519	0456	0469	0544	0412	0441	0341	0447	0570	0426	0462
Total cost.....	7663	6407	6375	6509	6600	7137	6376	5795	5127	6068	6992	6140	6364
Dry excavation—Prism, by contract, cubic yards.....	9,296	4,536	.....	3,920	4,900	13,832	16,824	7,496	25,456	31,400	28,420	32,266	178,296
Contract cost.....	\$0.3500	\$0.3500	.....	\$0.2100	\$0.2100	\$0.2107	\$0.2118	\$0.2121	\$0.2127	\$0.2120	\$0.3503	\$0.2966	\$0.2600
Plant arbitrary.....	1000	1000	.....	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Total cost.....	4500	4500	.....	3100	3100	3107	3118	3121	3127	3120	4503	3966	3600
Total dry excavation, quantities, cubic yards.....	1,319,916	1,612,118	.....	1,591,723	1,470,436	1,408,881	1,611,779	1,628,888	2,026,087	1,516,439	1,328,883	1,433,304	18,522,692
Unit cost.....	\$0.7641	\$0.6402	.....	\$0.6501	\$0.6589	\$0.7098	\$0.6342	\$0.5753	\$0.5102	\$0.1007	\$0.6841	\$0.6091	\$0.6337

1 Indicates a credit.

## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 1.—Dry excavation—Continued.

## PACIFIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
<b>PRISM.</b>													
Dry excavation.....cubic yards.	890							15,271	27,534	45,864	33,445	75,466	196,770
Drilling.....									\$0.0883	\$0.0841	\$0.0641	\$0.0670	\$0.0491
Blasting.....									.0628	.0329	.0359	.0478	.0359
Loading by power.....	\$1.0981							\$0.1265	\$0.2005	.1153	.1464	.1171	.1384
Tracks.....	.4908							.1102	.0136	.1731	.1522	.1300	.0628
Transportation.....	1.0133							.0746	.0520	.0649	.1040	.0924	.1275
Dumps.....	1.6633								.0097	.0267	.0497	.0454	.0299
Pumps.....	.0570							.0186	.0139	.0381	.0399	.0336	.0319
Maintenance of equipment.....	.0140							.0733	.0403	.0506	.0810	.0992	.0743
Plant arbitrary.....	.1100							.1000	.1003	.1011	.1037	.1010	.1010
Division expense.....	.1923							.0209	.0129	.0190	.0327	.0292	.0253
Total division cost.....	2.3122							.5241	.4432	.6389	.8266	.7819	.6960
Administrative and general expense.....	.4633							.0429	.0315	.0697	.0677	.0607	.0637
Total cost.....	2.7755							.5670	.4747	.7086	.9143	.8426	.7597
<b>PEDRO MIGUEL LOCKS.</b>													
Dry excavation.....cubic yards.							6,734	5,153				4,536	16,423
Drilling.....												\$0.0671	\$0.0241
Blasting.....								\$0.2813				.0041	.0010
Loading by power.....							.0221	.1674				.2221	.1956
Tracks.....							.0623	.0896				.1175	.0941
Transportation.....							.0202					.1550	.1088
Dumps.....							.0253	.0258				.0083	.0083
Pumps.....							.0897	.0940				.0491	.0320
Maintenance of equipment.....							.0026	.0019				.0009	.0019
Plant arbitrary.....							.0188	.0324				.0379	.0294
Division expense.....							.3831	.0924				.8136	.6991
Total division cost.....							.0889	.0710				.0386	.0386
Administrative and general expense.....							.4220	.7634				.9885	.6590
Total cost.....													
Preparing foundations, excavation, cubic yards.....	4,410	12,789	10,405	7,433	10,636	11,195	8,956	1,656	674	285	5,520	2,918	76,847
Drilling.....	\$0.6486	\$0.3308	\$0.5323	\$0.8203	\$0.3343	\$0.2139	\$0.3159	\$0.6317	\$1.9193	\$4.8913	\$0.2759	\$0.4840	\$0.4428
Blasting.....	.1873	.0874	.1176	.1573	.1025	.0819	.1172	.3351	.4594	.9515	.0968	.1590	.1215
Loading by power.....	.1795	.1869	.2628	.1973	.2182	.2073	.2360		1.0446		.2767		.2116



Items.	July.		August.	
	Quantity.	Unit cost.	Quantity.	Unit cost.
<b>PRISM.</b>				
Pipe lines.....	<i>Cu. yds.</i>		<i>Cu. yds.</i>	
Dikes.....	423,092	\$0.0215	508,829	\$0.04
Clearing.....	423,092	.0006	508,829	.06
Seagoing suction dredge:				
Operation.....	292,272	.0349	285,510	.03
Repairs.....	292,272	.0116	285,510	.06
Ladder dredges:				
Operation.....	130,820	.0630	131,090	.06
Repairs.....	130,820	.0259	131,090	.04
Dipper dredges:				
Operation.....			80,598	.06
Repairs.....			80,598	.04
Pipe-line dredges:				
Operation.....			11,631	.17
Repairs.....			11,631	.21
Tugs, clapnets, and scoops:				
Operation.....	130,820	.0845	211,688	.06
Repairs.....	130,820	.0807	211,688	.06
Drilling.....	27,938	.1068	44,564	.09
Blasting.....	27,938	.2894	44,564	.06
Small boats.....	423,092	.0017	508,829	.00
Repairs miscellaneous equipment.....	423,092	.0013	508,829	.00
Plant arbitrary.....	423,092	.0680	508,829	.08
Division expense.....	423,092	.0136	508,829	.01
Total division cost.....	423,092	.2261	508,829	.24
Administrative and general expense.....	423,092	.0177	508,829	.02
Total cost.....	423,092	.2438	508,829	.27
Earth excavation..... per cent..	395,154	93.40	464,265	91.1
Rock excavation..... do.....	27,938	6.60	44,564	8.9

<b>PRISM.</b>				
Clearing.....	515,782	\$0.0019	506,969	\$0.00
Seagoing suction dredge:				
Operation.....	240,646	.0417	245,741	.04
Repairs.....	240,646	.0211	245,741	.09
Ladder dredges:				
Operation.....	213,194	.0636	190,941	.05
Repairs.....	213,194	.0096	190,941	.04
Dipper dredges:				
Operation.....	61,943	.0863	70,287	.06
Repairs.....	61,943	.0427	70,287	.06
Tugs, clapnets, and scoops:				
Operation.....	275,137	.0577	261,228	.05
Repairs.....	275,137	.0471	261,228	.04
Drilling.....	22,024	.2193	12,620	.42
Blasting.....	22,024	.1580	12,620	.57
Operation drill barges.....	22,024	.1117	12,620	.31
Operation rock breakers.....	22, 24	.0701	12,620	.14
Small boats.....	515,782	.0028	506,969	.00
Repairs miscellaneous equipment.....	515,782	.0033	506,969	.00
Plant arbitrary.....	515,782	.1100	506,969	.11
Division expense.....	515,782	.0093	506,969	.00
Total division cost.....	515,782	.2823	506,969	.29
Administrative and general expense.....	515,782	.0422	506,969	.02
Total cost.....	515,782	.3245	506,969	.32
Earth excavation..... per cent..	493,758	95.73	494,349	97.1
Rock excavation..... do.....	22,024	4.27	12,620	2.9

Leading by hand.....	1.5338	4.2390	62715	8900	4099	4732	6465	1.0825	2.2616	1.0851	7387	1.1493	6708
Transportation.....	3206	2682	1877	2204	1296	1422	1087	2005	5306	6301	0484	0377	1701
Trucks (freights).....	2508	2240	1106	3154	3828	1049	0570	2681	1385	3.3067	0489	2546	2193
Dumps.....	8799	6313	0887	0973	0851	1016	0278	0681	0681	0004	0111	0470	0684
Pumps (power).....	0323	0323	0323	0323	0323	0323	0323	0323	0323	0323	0323	0323	0323
Maintenance of equipment.....	1837	1361	0323	0323	1889	1120	1529	2900	5849	1087	2553	0975	1933
Plant arbitrary.....	6800	6800	1106	1866	1869	1120	0028	0019	0015	0685	0019	0019	1931
Division expense.....	2220	0684	1106	1845	1087	0613	1210	1991	3049	480	0689	1357	1288
Total division cost.....	4.6337	2.4075	2.1910	3.0421	1.9930	1.6587	1.8147	3.0610	6.2422	11.9240	1.8392	2.3246	2.3746
Administrative and general expense.....	1.9801	2359	2635	2682	2355	1767	2272	3914	7235	1.4806	2236	2488	2872
Total.....	5.5838	2.7314	2.4545	3.3403	2.1744	1.8364	2.0419	3.4524	6.9658	13.4054	2.0598	2.5684	2.6618
MIRAFLORES LOCKS.													
Dry excavation..... cubic yards.....							13.762		63.379	77.521	56.295	36.743	247.700
Drilling.....									\$0.1015	\$0.0381	\$0.1293	\$0.1199	\$0.0837
Blasting.....									0339	0613	0510	0852	0557
Loading by power.....							\$0.0728		1778	0993	1221	1054	1319
Trucks.....							3764		1925	2138	1724	1726	2114
Transportation.....							0446		0483	0533	0864	0736	0623
Dumps.....										0227	0227	0350	0139
Pumps.....							0168			0391	0297	0290	0147
Maintenance of equipment.....							0541		0309	0456	0520	0900	0497
Plant arbitrary.....							0900		0900	0900	0900	0900	0900
Division expense.....							0235		0207	0163	0321	0322	0251
Total division cost.....							6782		6346	5734	8325	8300	7378
Administrative and general expense.....							0653		0684	0613	0691	0672	0712
Total cost.....							7485		7650	6347	9216	9032	8090
Preparing foundations..... cubic yards.....	11.990	17.548	8.590	9.850	9.400	17.906	34.982	12.836	9.300	2.230	1.680	1.280	137.762
Drilling.....	\$0.5896	\$0.3426	\$0.3931	\$0.5204	\$0.5859	\$0.4306	\$0.1577	\$0.5742	\$0.1595	\$0.7892	\$0.9206	\$0.2681	\$0.3840
Blasting.....	1348	0762	1270	1260	1427	0810	0803	1213	0832	2062	1657	0168	0977
Loading by power.....	1834	1361	2237	0901	1901	1272	0789	1723	1147	2682	1657	0168	1291
Trucks.....	5750	3632	1908	9269	7138	3810	1414	3026	5280	1147	1657	0168	1291
Transportation.....	1497	1308	1908	1261	0728	0882	0444	0861	0457	1.7822	1.7760	1.3666	4314
Dumps.....	3323	1667	1747	1916	1124	1158	0472	1407	0245	0514	2577	4324	1001
Pumps.....	1213	0545	0531	0447	0814	0430	0168	0186	0126	0514	1025	0246	1293
Maintenance of equipment.....	10104	0692	0830	0700	0907	0503	0992	0833	0506	1388	0391	0290	0419
Plant arbitrary.....	0773	0800	0800	0800	0800	0818	0900	0900	0900	0900	3171	3186	0857
Division expense.....	1360	0740	1472	1589	1184	0620	0356	0722	0636	1852	2026	1310	0845
Total division cost.....	2.3090	1.4933	2.5406	2.3337	2.1826	1.4911	7391	1.6618	1.1821	3.2626	3.9013	2.7088	1.8085
Administrative and general expense.....	5293	1765	3346	2511	2522	1303	0705	1.465	1.465	4343	4970	2618	1986
Total cost.....	2.8353	1.6698	2.8842	2.6043	2.4358	1.6114	8086	1.8083	1.3506	3.7171	4.3992	2.9706	1.8070

! Indicates credit.

## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 3.—*Hydraulic excavation.*

## ATLANTIC DIVISION.

Items.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>PRISM.</b>							
Hydraulic excavation.....cubic yards.		5,200	9,055	5,350	5,500	3,500	28,605
Pumping station.....							
Pipe lines.....							
Dredging pumps.....		\$0.1081	\$0.0623	\$0.1281	\$0.3231	\$0.5705	\$0.1854
Relay pumps.....							
Dikes.....							
Monitors.....							
Maintenance of equipment.....							
Power.....		.1190	.1190	.0076	.0142	.0318	.0588
Plant arbitrary.....		.0118	.0157				.0152
Division expense.....		.2389	.1970	.1357	.3373	.6023	.2699
Total division cost.....		.0372	.0465	.0176	.0379	.0649	.0400
Administrative and general expenses.....							
Total cost.....		.2761	.2435	.1543	.3732	.6672	.3099

## PACIFIC DIVISION.

<b>PRISM.</b>							
Hydraulic excavation.....cubic yards.			91,957	33,509	18,353	53,858	197,677
Pumping station.....			\$0.0763	\$0.1794	\$0.2815	\$0.1036	\$0.1203
Pipe lines and monitors.....			.0312	.0312	.1413	.0949	.0714
Dredging pumps.....			.0868	.1175	.1457	.0731	.0716
Relay pumps.....							
Dikes.....			.0215				.0100
Maintenance of equipment.....			.0436	.0772	.0923	.0771	.0630
Power.....			.1243	.2814	.4482	.1919	.1850
Plant arbitrary.....			.0678	.0694	.0735	.0606	.0630
Division expense.....			.0094	.0230	.0836	.0146	.0153
Total division cost.....			.4050	.8323	1.2211	.6160	.6106
Administrative and general expenses.....			.0272	.0780	.1064	.0379	.0460
Total cost.....			.4322	.9103	1.3265	.6539	.6566

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>MIRAFLORES LOCKS.</b>													
Hydraulic excavation..... cubic yards..				40,000	47,444	66,661	80,243	87,335					333,706
Pumping station.....				\$0.1401	\$0.1467	\$0.1006	\$0.0920	\$0.0791					\$0.0649
Pipe lines.....				.0725	.0486	.0525	.0471	.0337					.0475
Dredging pumps.....				.0725	.0786	.6773	.0471	.0638					.0431
Relay pumps.....				.0422	.0110	.0110	.0008	.0001					.0024
Dikes.....				.0104		1.0061		.0057					.0265
Motors.....				.0002	.0002								
Maintenance of equipment.....				.0251	.1502	.0455	.0238	.0267					.0547
Power.....				.4041	.2893	.1738	.1703	.1406					.1865
Plant arbitrary.....				.0470	.0390	.0400	.0400	.0400					.0439
Division expense.....				.0132	.0155	.0133	.0116	.0124					.0135
Total division cost.....				.7971	.7695	.5269	.3811	.4734					.5496
Administrative and general expenses.....				.0437	.0325	.0636	.0256	.0009					.0284
Total cost.....				.8408	.8220	.5905	.4079	.5063					.5870

1 Indicates a credit.



## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 4.—*Masonry.*  
ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>GATUN LOCKS.</b>													
Concrete.....cubic yards.	77,470	77,635	69,089	78,535	68,534	73,100	67,257	66,014	79,601	62,021	60,818	49,263	829,317
Cement.....	\$1,8961	\$1,8947	\$1,8359	\$1,8735	\$1,8471	\$1,8074	\$1,8413	\$1,7225	\$1,7265	\$1,7466	\$1,7429	\$1,6919	\$1,754
Stone.....	2,3020	2,3486	2,2559	2,2074	2,1168	2,0771	2,0301	1,9857	1,8843	1,8513	1,9407	1,9441	2,0860
Sand.....	7239	1,0152	1,0091	1,0236	7752	2,7919	8421	9063	8126	8087	7019	8046	8614
Mixing.....	.1326	.1897	.2162	.1859	.2135	.1643	.1608	.1574	.1432	.1783	.1904	.1814	.1756
Total cost.....	5,1175	5,4522	5,3171	5,2904	4,9524	4,8407	4,8743	4,7661	4,5790	4,5849	4,2559	4,6320	4,9114
Large rock.....cubic yards.	6,531	9,051	7,681	8,414	6,618	6,840	4,972	5,051	5,698	3,735	5,407	4,611	73,609
Cost.....	\$1,4424	\$1,3815	\$1,2412	\$1,0004	\$1,1499	\$1,4549	\$1,2373	\$1,0684	\$1,3516	\$1,5588	\$2,5514	\$0,9705	\$1,5366
Masonry.....cubic yards.	84,001	85,183	76,720	86,949	75,152	79,940	72,229	71,065	85,299	65,756	66,225	53,904	902,926
Concrete.....	\$4,7106	\$4,9399	\$4,7847	\$4,7785	\$4,6163	\$4,4214	\$4,5368	\$4,4274	\$4,2638	\$4,3245	\$3,9865	\$4,2357	\$4,5111
Large rock.....	1121	1,298	1,243	1,243	1,012	1,253	1,0832	1,0759	1,093	1,0893	1,020	1,0831	1,090
Wood forms.....	2675	4154	4204	3540	3021	4132	4694	3611	3218	4008	4242	4182	3892
Steel forms.....	6906	6915	1114	1047	681	6938	1070	6709	1077	1037	1167	1701	1067
Piling.....	3155	2526	2813	3988	4522	3315	3317	3297	2720	3241	3204	3608	3285
Reinforcements.....	0209	0284	0374	0535	0000	0264	0801	0068	0130	0078	0452	0126	0241
Pumps.....	0262	0483	0278	0067	0000	0530	0750	0292	0533	0873	1129	0925	0417
Power.....	0617	0633	0645	0700	0655	0690	0750	0690	0539	0661	0826	0497	0666
Maintenance of equipment.....	1312	1847	2885	2558	2890	2422	2967	2227	2249	2116	1912	2474	2357
Plant arbitrary.....	6850	6850	6850	6850	6850	6850	7110	7110	7110	7110	7110	7110	6069
Division expense.....	.1011	.1145	.1243	.1260	.1104	.0754	.0822	.0671	.0663	.0738	.0701	.0918	.0914
Total division cost.....	6,5514	6,9534	6,9506	6,9179	6,6822	6,5262	6,7261	6,3783	6,1500	6,4079	6,1748	6,5729	6,5919
Administrative and general expenses.....	.1572	.2143	.2592	.2778	.2407	.1854	.2193	.1633	.1650	.2390	.2463	.2744	.2208
Total cost.....	6,7086	7,1677	7,2098	7,1957	6,9219	6,7116	6,9454	6,5501	6,3150	6,6469	6,4241	6,8473	6,8197
<b>Masonry, reinforced.....cubic yards.</b>													
Cement.....	.....	.....	.....	.....	.....	272	690	1,039	1,585	1,605	1,619	1,401	8,211
Stone.....	.....	.....	.....	.....	.....	\$3,1200	\$3,5390	\$2,1815	\$2,0267	\$2,3717	\$1,9827	\$2,1590	\$2,2005
Sand.....	.....	.....	.....	.....	.....	2,3193	1,9359	1,6217	1,4673	1,5853	1,7855	1,7855	1,6671
Forms.....	.....	.....	.....	.....	.....	8800	8415	7426	6347	5939	6928	9408	7286
Mixing.....	.....	.....	.....	.....	.....	2,4209	2,0267	2,7117	3,8064	2,6943	2,8515	5,2065	3,1047
Piling.....	.....	.....	.....	.....	.....	5,1739	1,4132	1,3006	1,3006	9015	1,2437	1,2891	1,3265
Total.....	.....	.....	.....	.....	.....	1,8031	2,7490	1,1626	1,8717	.9059	1,0721	.8238	1,2116

Reinforcements.....						2 1729	1 9413	1 2657	.8322	.3928	.7686	.7658	.9094
Maintenance of equipment.....								.2452	.0633	.0666	.2457	.1512	.1613
Plant arbitrary.....						.6850	.7110	.7110	.7110	.7110	.7110	.7110	.7110
Division expense.....						.7792	.4883	.2418	.3839	.2514	.2754	.3838	.3889
Total division cost.....						19 3540	16 0005	11 8487	12 6689	9 2977	11 5294	14 2265	12 4487
Administrative and general expenses.....						1 7683	1 2949	.9904	1 2845	.7195	1 0626	1 4230	1 1779
Total cost.....						21 1222	17 2654	12 8891	13 9034	10 0172	12 6120	15 6465	13 5766
Total masonry.....						80 212	72 919	79 104	86 884	67 871	87 844	55 305	911 137
Total cost.....						\$3 7605	\$7 0434	\$6 6408	\$6 4535	\$5 7772	\$6 5718	\$7 0702	\$3 8737
GATUN RAILWAY.													
Concrete.....													
Cement.....						7 224	5 622	6 009	8 704	4 109	3 656	4 830	58 550
Stone.....						\$1 7680	\$1 7782	\$1 7972	\$1 7660	\$1 9118	\$1 6243	\$1 7286	\$1 7902
Sand.....						2 2052	2 3290	1 6079	1 6079	1 6440	1 6915	1 7076	1 9539
Mixing.....						.5337	.3735	.7679	.6699	.8328	.6247	.6766	.6063
Total cost.....						.1533	.1812	.1679	.1764	.3250	.2659	.2741	.2352
Large rock.....						4 5746	4 6382	4 4108	4 2192	4 7136	4 2364	4 3869	4 6176
Cost.....						181	129						1 101
Masonry.....						\$2 7269	\$3 6477						\$2 0447
Concrete.....													
Large rock.....						7 415	5 651	6 009	8 704	4 109	3 656	4 830	58 651
Wood forms.....						\$4 5447	\$4 5526	\$4 4108	\$4 2192	\$4 7136	\$4 2364	\$4 3869	\$4 8324
Placing.....						.0665	.0832	.0142					.0377
Cotters.....						.3676	.4761	.6734	.3315	.5776	1 0276	.5220	.5924
Reinforcements.....						.6307	.6804	1 8924	.5338	.4298	.6132	.4604	.6170
Pumps.....									.0335	.2703	1 1646	.0461	.0333
Maintenance of equipment.....								.0154	.0006	.0020	.0633	.0077	.0077
Plant arbitrary.....						.3393	.1643	.1129	.2036	.0132	.0550	.1076	.0332
Division expense.....						.6160	.6160	.4670	.4670	.4670	.4670	.4670	.5399
Total division cost.....						1501	1216	.0527	.0461	.1184	.0680	.0690	.1174
Administrative and general expense.....						6 7322	6 6942	5 8887	6 8702	6 8702	6 3346	6 1702	6 7044
Total cost.....						8 0288	7 7512	5 7740	5 8387	6 8702	6 3346	6 1702	6 7044
						.3453	.3403	.1461	.3157	.3157	.3269	.3453	.2829
						8 4042	8 0915	5 9624	5 9848	7 1899	6 6636	6 5155	6 9873

! Indicates a credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 4.—Masonry—Continued.

PACIFIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>MIRAFLORES LOCKS.</b>													
Concrete.....cubic yards.	3, 672	5, 755	17, 795	21, 562	23, 148	21, 065	23, 436	20, 399	30, 930	38, 758	36, 154	26, 536	286, 240
Cement.....	\$1. 5407	\$2. 3902	\$1. 3999	\$1. 4612	\$1. 3793	\$1. 3383	\$1. 4801	\$1. 3070	\$1. 4166	\$1. 5457	\$1. 2126	\$1. 8819	\$1. 4665
Stone.....	1, 0978	.9677	.8434	.6881	.7905	.7812	.8463	.8835	.8463	.8184	.7812	.7812	.8132
Sand.....	3, 3671	.3827	.3948	.3719	.3907	.3807	.3901	.4042	.4089	.4089	.4042	.3901	.3946
Mixing.....	1, 2084	.9979	.5839	.6881	.6479	.5947	.6410	.5624	.5248	.4053	.5204	.5877	.5226
Total cost.....	4, 2140	4, 7385	3, 2008	3, 2093	3, 2125	3, 0949	3, 2575	3, 1871	3, 1966	3, 1783	2, 7184	3, 4109	3, 1969
Large rock.....cubic yards.	.....	.....	338	597	723	438	582	497	245	.....	.....	.....	3, 063
Cost.....	.....	275	\$0. 4036	\$1. 7612	\$0. 7919	\$1. 1058	\$0. 5629	\$0. 3570	\$0. 5957	.....	.....	.....	\$0. 7838
Masonry.....cubic yards.	3, 672	6, 030	18, 133	22, 159	23, 871	21, 533	24, 018	20, 896	31, 173	38, 758	36, 154	26, 536	272, 933
Concrete.....	\$4. 2140	\$4. 5224	\$3. 1411	\$3. 1229	\$3. 1152	\$3. 0319	\$3. 1785	\$3. 1113	\$3. 1717	\$3. 1783	\$2. 7184	\$3. 4109	\$3. 1537
Large rock.....	.....	.....	.0075	.0474	.0240	.0224	.0137	.0085	.0046	.....	.....	.....	.0106
Wood forms.....	5658	.4433	.5937	.4021	.3038	.4272	.3364	.3963	.3299	.3031	.2882	.7831	.4040
Steel forms.....	3549	1.791	.0880	.1261	.1805	.1163	.1120	.0552	.0342	.0500	.0315	.0906	.0776
Placing.....	3156	.2117	.3591	.2782	.2454	.3063	.2647	.2883	.1871	.1622	.2193	.2553	.2448
Reinforcements.....	.....	.0029	.3815	.0007	.0210	.0091	.0154	.0107	.0128	.0187	.0585	.0552	.0472
Pumps.....	1149	.0545	.0531	.0447	.0596	.0411	.0164	.0181	.0128	.0419	.0391	.0290	.0366
Power.....	.....	.0132	.0116	.0189	.0133	.0161	.0152	.0129	.0069	.0111	.0218	.0397	.0163
Maintenance of equipment.....	2407	.0635	.1774	.1983	.1117	.1746	.1987	.1572	.1746	.1046	.1834	.2087	.1688
Plant arbitrary.....	4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500
Division expense.....	1315	.1315	.1080	.1468	.1129	.0986	.1108	.1020	.0796	.0703	.0762	.1002	.0990
Total division cost.....	6, 4466	6, 1021	5, 3410	4, 8381	4, 5873	4, 7435	4, 6988	4, 5735	4, 4230	4, 3502	4, 0464	5, 3277	4, 6826
Administrative and general expense.....	7390	.4250	.4040	.3225	.3844	.3435	.3422	.2795	.2841	.1828	.3107	.3182	.3151
Total cost.....	7, 1856	6, 5271	5, 7490	5, 1606	4, 9717	5, 0870	5, 0120	4, 8530	4, 7071	4, 5390	4, 3571	5, 6459	4, 9977
<b>PEDRO MIGUEL LOCKS.</b>													
Concrete.....cubic yards.	40, 937	50, 583	80, 243	61, 183	64, 003	42, 572	38, 400	36, 965	44, 716	28, 635	18, 905	17, 875	495, 087
Cement.....	\$1. 5332	\$1. 9399	\$1. 4323	\$1. 5163	\$1. 3292	\$1. 3681	\$1. 7444	\$1. 3698	\$1. 6378	\$1. 7282	\$1. 1894	\$1. 5756	\$1. 5365
Stone.....	9545	.9390	.8363	.6722	.7905	.7812	.8463	.8835	.8463	.8184	.7812	.7812	.8132

Sand.....	2206	3704	3700	3933	3948	3907	3901	4042	4089	3901	3728
Mixing.....	1760	1283	1321	1676	1416	2007	1527	2241	2649	3065	1771
Total cost.....	2,8843	3,3696	2,7727	2,7194	2,6561	2,7657	3,1335	2,5999	3,2020	3,0634	2,9107
Large rock.....	527	681	459	239	245	262	113	26	.....	213	2,765
Cost.....	\$2,6534	\$1,5038	\$0,6608	\$1,4403	\$0,0004	\$0,9299	\$0,7828	\$0,2484	.....	\$0,2808	\$1,1463
Masonry.....	41,464	51,264	50,702	61,422	64,248	42,834	38,513	37,011	28,635	18,088	497,802
Concrete.....	\$2,8470	\$3,3248	\$2,7475	\$2,7059	\$2,6459	\$2,7339	\$3,1243	\$2,8747	\$3,2040	\$3,0174	\$2,8945
Large rock.....	6261	7210	6049	3056	3004	3057	1023	0007	.....	0033	1004
Wood forms.....	3491	2919	2619	2714	2682	4364	4307	5574	3906	5603	3004
Steel forms.....	0881	0776	0814	0406	0462	0396	0627	0274	0163	0093	0463
Placing.....	3119	2770	2492	2410	2637	4038	3340	2708	3957	4328	3118
Reinforcements.....	0035	0036	0064	0010	0045	0435	0819	0779	0439	0989	1987
Pumps.....	0577	0826	0842	0332	0280	0490	0282	0258	0176	0485	0545
Power.....	0637	0598	0488	0458	0354	0411	0406	0381	0416	0485	0454
Maintenance of equipment.....	1008	1294	1838	2171	1466	1928	1739	1679	1963	2139	1728
Plant arbitrary.....	6646	6658	6653	6652	6652	6680	7123	7155	7172	7140	6647
Division expense.....	0645	0673	0633	0609	0677	0784	0940	0928	0905	1022	0792
Total division cost.....	4,6040	4,9096	4,3832	4,3339	4,1964	4,6922	5,0289	4,8894	4,8351	5,2115	4,7040
Administrative and general expense.....	2480	2242	2649	2281	2632	3107	3362	2702	2887	2694	2787
Total cost.....	4,8500	5,1428	4,6481	4,5570	4,4896	5,0029	5,3681	5,1696	5,1238	5,5079	4,9827
Masonry, reinforced.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	386
Cement.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sand.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Forms.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mixing.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Placing.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Reinforcements.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Maintenance of equipment.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Plant arbitrary.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Division expense.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total division cost.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Administrative and general expense.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total cost.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total masonry.....	41,464	51,264	50,702	61,422	64,248	42,834	38,513	37,011	28,635	18,088	498,187
Total cost.....	\$4,5500	\$5,1428	\$4,6481	\$4,5570	\$4,4896	\$5,0029	\$5,3681	\$5,1696	\$5,1238	\$5,5079	\$4,9841

Placing of "Masonry, reenforced," was charged to "Masonry" in May, no separate account having been kept.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 5.—Dry filling.

## ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>GATUN DAM.</b>													
Dry fill.....cubic yards.	180,111	229,774	223,102	259,919	266,105	199,575	218,690	211,008	255,047	205,130	207,751	227,996	2,053,908
Excavation.....	\$0.0056	\$0.0033	\$0.0068	\$0.0024	\$0.0010	\$0.0019	\$0.0148	\$0.0066	\$0.0118	\$0.0279	\$0.0255	\$0.0287	\$0.0096
Clearing site.....	.0940	.0604	.0533	.0524	.0415	.0742	.0545	.0008	.0004	.0007	.0006	.0006	.0021
Tracks.....	.0228	.0042	.0078	.0092	.0153	.0412	.0345	.0048	.0385	.0473	.0537	.0332	.0530
Trestle.....	.0142	.0618	.1406	.0628	.0859	.0897	.0218	.1270	.0654	.1358	.1113	.0018	.0107
Transportation.....	.0909	.0965	.0969	.0773	.0708	.1112	.0815	.0834	.0678	.0900	.0922	.1149	.0998
Filling.....	.0883	.0074	.0399	.0223	.0398	.0897	.0352	.0512	.0483	.0456	.0259	.0274	.0316
Maintenance of equipment.....	.0770	.0770	.0770	.0700	.0700	.0717	.0932	.1001	.0986	.0979	.0946	.0946	.0662
Plant arbitrary.....	.0251	.0222	.0192	.0145	.0119	.0149	.0139	.0060	.0086	.0112	.0120	.0127	.0144
Division expense.....													
Total division cost.....	.3179	.3288	.4113	.3309	.3363	.4578	.3500	.4257	.3669	.4998	.4170	.4007	.3813
Administrative and general expenses.....	.0339	.0284	.0329	.0254	.0247	.0368	.0307	.0255	.0221	.0316	.0357	.0219	.0286
Total cost.....	.3518	.3572	.4442	.3563	.3610	.4946	.3807	.4512	.3890	.5314	.4527	.4226	.4099
<b>Paving</b>	7,602	5,236	5,536										18,374
Clearing site.....	\$0.0056	\$0.0033	\$0.0068										\$0.0063
Filling.....	.2118	.1081	.2056										.1789
Plant arbitrary.....	.0770	.0770	.0770										.0770
Division expenses.....	.0300	.0140	.0160										.0212
Total division cost.....	.3244	.1974	.3054										.2824
Administrative and general expenses.....	.0367	.0163	.0310										.0293
Total cost.....	.3611	.2137	.3364										.3117
<b>GATUN-MUNDI LEVER.</b>													
Dry fill.....cubic yards.	19,619	17,591	13,249	697									51,156
Tracks.....				\$0.4394									.0090
Filling.....	\$0.1207	\$0.0813	\$0.0865	.0829									.1008
Plant arbitrary.....	.0770	.0770	.0770	.0700									.0799
Division expense.....	.0170	.0110	.0117	.0656									.0142
Total division cost.....	.2147	.1693	.1872	.6379									.1979
Administrative and general expenses.....	.0208	.0151	.0156	.0824									.0184
Total cost.....	.2355	.1844	.2031	.7493									.2163

## GATUN SPILLWAY.

Back filling..... cubic yards	3, 614	942	2, 600							566	1, 292	3, 830	12, 873
Loading by power.													
Tracks.....													\$0. 0621
Filling.....	\$0. 0022										\$0. 0449	\$0. 0679	\$0. 2670
Plant arbitrary.....	.1100										.1756	.1741	.0724
Division expense.....	.0003										.0322	.0227	.0376
Total division cost.....	.1126										.0322	.0312	.0241
Administrative and general expense.....	.0004										.1118	.0632	.0601
Total cost.....	.1130									5. 2690	.9106	.5916	.5433
GATUN LOCKS.													
Preparing foundations filling, cubic yards.	20, 296	1, 938											22, 234
Total cost (filling).....	\$0. 1757	\$0. 2695											\$0. 1539
Back filling..... cubic yards	3, 458	18, 918	26, 410	58, 889	37, 139	49, 344	66, 589	41, 153	40, 515	77, 880	65, 008	49, 796	535, 069
Blasting.....													
Loading.....													
Tracks.....	\$0. 0049		\$0. 0519	\$0. 0223	\$0. 0646	\$0. 0611	\$0. 0350	\$0. 0563	\$0. 0664	\$0. 0222	\$0. 0011	\$0. 0003	\$0. 0005
Filling.....	.8380	.2832	.2108	.1165	.3106	.2108	.1165	.1522	.3107	.0429	.0270	.0250	.0379
Transportation.....	.0119	.0900	.0966	.0833	.0277	.0966	.0833	.1272	.1000	.0309	.0946	.1425	.1644
Maintenance of equipment.....	.1781	.1106	.1760	.1411	.2344	.1760	.1411	.1162	.1216	.0639	.0946	.0652	.0663
Plant arbitrary.....	.0354	.0945	.0655	.0472	.0643	.0655	.0472	.0263	.0353	.0421	.0263	.0496	.1108
Division expense.....	.1100	.0737	.1100	.1100	.1100	.1100	.1100	.1190	.1190	.0241	.0292	.0193	.0407
Total division cost.....	.1632	.0617	.0434	.0257	.0445	.0335	.0265	.0229	.0134	.0103	.0114	.0235	.0247
Administrative and general expense.....	3, 124	.6210	.6723	.4219	.9209	.7461	.4578	.6630	.7694	.2264	.2679	.4755	.5307
Total cost.....	.3344	.0633	.0860	.0304	.1262	.0768	.0436	.0661	.0420	.0266	.0325	.0514	.0649
Filling center wall..... cubic yards.	3, 498	7, 143	7, 583	4, 523	1, 0411	8, 229	5, 014	7, 771	8, 114	2, 530	3, 004	5, 269	5, 856
Tracks.....													
Transportation.....													
Filling.....													
Maintenance of equipment.....													
Division expense.....													
Total division cost.....													
Administrative and general expense.....													
Total cost.....													
Filling center wall..... cubic yards.													
Tracks.....													
Transportation.....													
Filling.....													
Maintenance of equipment.....													
Division expense.....													
Total division cost.....													
Administrative and general expense.....													
Total cost.....													

1 Indicates a credit.

## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 5.—*Dry filling*—Continued.

## PACIFIC DIVISION.

PEDRO MIGUEL LOCKS.									
Back filling.....cubic yards.	3, 967	2, 360	578	1, 755	3, 822	7, 989	31, 072	31, 399	96, 097
Loading by power.....	\$0.1522	\$0.2892	\$0.2171				\$0.0876		\$0.0236
Transportation.....	1129	1048					0449		0849
Tracks.....	0330	0645		\$0.1283	\$0.1559	\$0.0307	1009	0302	0833
Filling.....	0989	0536	0461		2307	1774	0835	0772	3505
Maintenance of equipment.....	0390	0271	0083		0903	0159	0335	0508	1678
Plant arbitrary.....	1000		1000		1016	0993	1000	1000	0421
Division expense.....	0312	0374	0198	0142	0468	0455	0189	0178	1000
Total division cost.....	.5672	.6766	.3914	.2425	.8543	1.1746	.3853	.4035	.7737
Administrative and general expense.....	.1210	.0831	.0445	.0212	.0885	.1282	.0535	.0351	.0675
Total cost.....	.6882	.7647	.4359	.2637	.9528	1.3028	.4221	.4386	.8412
MIRAFLORES LOCKS.									
Back filling.....cubic yards.	6, 110	6, 355					1, 000	1, 280	
Loading by power.....									
Transportation.....	\$0.1517	\$0.0580					\$0.0708		\$0.0120
Tracks.....	0831	1230					1050	0285	0057
Filling.....	1520	0253					2810	1390	1323
Maintenance of equipment.....	0560	0239					1000	1000	1449
Plant arbitrary.....	1000						\$0.1000	1000	0230
Division expense.....	0313	0143					0137	0186	0465
Total division cost.....	.5741	.3445					.3180	.4130	1000
Administrative and general expense.....	.1215	.0346					.0267	.0467	.5173
Total cost.....	.6956	.3791					.1000	.4597	.0365
MIRAFLORES DAM.									
Dry fill.....cubic yards.	4, 280	10, 896	11, 220	14, 370	8, 980	39, 224	24, 685	32, 404	30, 032
Tracks.....	\$0.0457	\$0.1266	\$0.1733	\$0.0443	\$0.1454	\$0.0189	\$0.0074	\$0.0113	\$0.0889
Transportation.....	1442	1587	1712	0916	0805	0486	0644	0879	0634
Filling.....	0703	0301	1284	1260	1643	0424	0978	0839	0835
Maintenance of equipment.....	.0524	.0443	.0460	.0360	.0354	.0126	.0641	.0368	.0284
Total division cost.....									
Administrative and general expense.....									
Total cost.....									
Back filling.....cubic yards.	273, 709	18, 871	14, 420	61, 379	96, 097	31, 399	31, 072	31, 399	96, 097
Loading by power.....	\$0.0236	\$0.0849	\$0.0833	\$0.0236	\$0.0324	\$0.0307	\$0.0408	\$0.0876	\$0.0236
Transportation.....	0849	0246	3505	1099	0772	1774	1009	0302	0833
Tracks.....	0651	2191	1678	0709	0335	0159	0335	0508	1678
Filling.....	0256	0582	1000	1000	1000	1000	1000	1000	0421
Maintenance of equipment.....	1000	1000	1000	1000	1000	1000	1000	1000	1000
Plant arbitrary.....	0180	0190	0280	0075	0055	0178	0189	0178	0055
Division expense.....									
Total division cost.....	.3800	.5294	.7737	.2782	.4035	1.1746	.3853	.4035	.7737
Administrative and general expense.....	.0315	.0845	.0675	.0132	.0535	.1282	.0535	.0351	.0675
Total cost.....	.4215	.5639	.8412	.3003	.4586	1.3028	.4221	.4386	.8412
MIRAFLORES LOCKS.									
Back filling.....cubic yards.	53, 321	16, 155	16, 021	6, 540			1, 000	1, 280	
Loading by power.....									
Transportation.....	\$0.0042	\$0.0022	\$0.0120	\$0.0015	\$0.0708		\$0.0708		\$0.0120
Tracks.....	0659	1323	0057	2810	1390	1449	1050	0285	0057
Filling.....	0659	1449	0230	0107	0239	1000	1000	1000	1449
Maintenance of equipment.....	0322	0465	1000	1000	1000	1000	1000	1000	0230
Plant arbitrary.....	1000	1000	1000	1000	1000	1000	1000	1000	1000
Division expense.....	0186	0195	0157	0186	0137	0186	0189	0178	0157
Total division cost.....	.4263	.5173	.3553	.4130	.3180	1.1746	.3853	.4035	.7737
Administrative and general expense.....	.0478	.0415	.0365	.0467	.0267	.1282	.0535	.0351	.0675
Total cost.....	.4771	.5688	.3928	.4597	.3447	1.3028	.4221	.4386	.8412
MIRAFLORES DAM.									
Dry fill.....cubic yards.	286, 398	28, 315	30, 032	67, 290	23, 940	32, 404	24, 685	32, 404	30, 032
Tracks.....	\$0.0839	\$0.0819	\$0.0889	\$0.0233	\$0.0553	\$0.0189	\$0.0074	\$0.0113	\$0.0889
Transportation.....	0634	0827	0634	0879	0644	0486	0644	0879	0634
Filling.....	0872	1125	0985	1185	1643	0424	0978	0839	0835
Maintenance of equipment.....	.0318	.0435	.0284	.0619	.0354	.0126	.0641	.0368	.0284
Total division cost.....									
Administrative and general expense.....									
Total cost.....									

Plant arbitrary.....	.1600	.1600	.1600	.1600	.1600	.1700	.1700	.1700	.1700	.1700	.1700	.1870
Division expense.....	.0201	.0156	.0309	.0246	.0317	.0066	.0094	.0171	.0052	.0145	.0139	.0131
Total division cost.....	.4927	.5303	.7078	.4815	.6973	.2890	.3367	.6087	.2870	.4635	.4645	.4102
Administrative and general expenses.....	.0779	.0427	.0723	.0382	.0617	.0139	.0382	.0404	.0163	.0385	.0281	.0288
Total cost.....	.5706	.5730	.7801	.5197	.6590	.3029	.5415	.5461	.3033	.5020	.4926	.4400

TABLE 6.—*Hydraulic filling.*

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>GATON DAM.</b>													
Hydraulic fill.....cubic yards.....	462,092	406,806	457,637	480,732	128,666	243,121	211,992	301,733	342,800	368,658	419,348	432,008	4,256,393
Clearing site.....	\$0.0056	\$0.0033	\$0.0038	\$0.0024	\$0.0010	\$0.0042	\$0.0014	\$0.0006	\$0.0004	\$0.0007	\$0.0005	\$0.0006	\$0.0024
Clearing for dredge.....	.0060	.0084	.0054	.0143	.0246	.0044	.0092	.0211	.0213	.0123	.0070	.0034	.0105
Dredging.....	.0844	.0894	.0729	.0848	.1324	.0804	.0836	.0761	.0844	.0838	.0885	.0878	.0716
Relay pumps.....	.0028	.0023	.0008	.0012	.0001	.0104	.0114	.0095	.0120	.0088	.0139	.0077	.0067
Pipe lines.....	.0268	.0112	.0179	.0037	.0908	.0226	.0336	.0146	.0226	.0088	.0110	.0449	.0286
Wood flumes.....	.....	.....	.....	.0088	.0124	.0028	.0068	.....	.0036	.0018	.0028	.0032	.0022
Power.....	.0124	.0130	.....	.....	.0830	.0083	.0003	.0450	.0431	.0074	.0450	.0028	.0064
Small boats.....	.0010	.0011	.0014	.0010	.0035	.0023	.0021	.0017	.0017	.0023	.0015	.0016	.0016
Maintenance of equipment.....	.0321	.0428	.0108	.0160	.2573	.0873	.0458	.0324	.0441	.0072	1.0672	.0325	.0270
Plant arbitrary.....	.0460	.0400	.0406	.0470	.0470	.0470	.0500	.0300	.0469	.0500	.0500	.0500	.0401
Division expense.....	.0084	.0090	.0057	.0078	.0262	.0068	.0074	.0042	.0051	.0045	.0042	.0044	.0066
Total division cost.....	.2082	.1995	.1707	.1700	.6242	.2560	.3616	.2582	.2642	.2149	.1370	.2585	.2289
Administrative and general expenses.....	.0131	.0172	.0141	.0154	.0763	.0164	.0335	.0208	.0162	.0181	.0140	.0150	.0182
Total cost.....	.2223	.2167	.1848	.1854	.7005	.2724	.3961	.2755	.2826	.2300	.1510	.2735	.2471

1 Indicates a credit.



## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 7.—Colon breakwater.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Excavation.....cubic yards.			6,862	30,762	29,904	38,998	46,849	35,135	45,453	40,669	38,534	46,664	359,880
Surveys.....			\$0.1091	\$0.0262	\$0.0270	\$0.0177	\$0.0037	\$0.0386	\$0.0135	\$0.0234	\$0.0192	\$0.0096	\$0.0242
Clearing.....			.1936	.0352	.0653	.0424	.0359	.0429	.0040	1.4044	.....	.0024	.0262
Drilling.....			.3666	.0546	.0631	.0600	.0654	.0633	.0470	.0645	.....	.0310	.0600
Blasting.....			.7979	.0246	.2493	.2027	.1262	.1831	.3173	.2761	.2803	.2028	.2492
Loading by power.....			.2256	.0654	.1027	.1076	.0656	.1440	.0844	.1191	.0669	.0662	.0664
Tracks.....			.9391	1.1699	.1482	.1111	.0318	.0556	.0788	.4132	.0203	.0785	.1208
Transportation.....			.1825	.0772	.1170	.0886	.0678	.1147	.0864	.1135	.1174	.1039	.1009
Maintenance of equipment.....			.9476	.0278	.0447	.0024	.0146	.0707	.1531	.0630	.0600	.0658	.0646
Total.....			3.1620	.1441	.8083	.6425	.4366	.7079	.7866	1.0003	.6496	.5532	.7623
Filling.....cubic yards.			6,862	30,762	29,904	38,998	46,849	35,135	45,453	40,669	38,534	46,664	359,880
Trestles.....			\$2.2622	\$1.0711	\$0.2101	\$0.3166	\$1.2586	\$0.8661	\$0.2991	\$0.1661	1.25.0007	\$0.2441	\$0.3629
Dumping.....			.1024	.0491	.0363	.0268	.0173	.0224	.0207	.0215	.0272	.0116	.0260
Maintenance of equipment.....			1.4004	.....	.0074	.0185	.0263	.1357	1.0025	.0171	.0165	.0148	.0132
Total.....			2.3622	1.1202	.2538	.3619	1.3022	.7942	.2773	.2047	1.2.0470	.2705	.4021
Plant arbitrary.....			.1100	.1100	.1100	.1100	.1690	.1690	.1690	.1690	.1690	.1690	.1515
Division expense.....			.6631	.1171	.0534	.0399	.0316	.0359	.0361	.0378	.0384	.0347	.0604
Tug service.....			.5047	.0717	.0394	.0504	.0608	.0464	.0480	.0691	.0643	.0369	.0663
Total division cost.....			6.7020	1.5631	1.2649	1.2047	2.0032	1.6854	1.2699	1.5109	1.1.1257	1.0393	1.4506
Administrative and general expenses.....			1.1289	.4175	.1852	.1604	.2.70	.1963	.1.534	.2046	1.1.1569	.1046	.2423
Grand total.....			7.8309	1.9806	1.4531	1.3651	2.2022	1.8807	1.4223	1.7155	1.9.0638	1.1.629	1.6629

<sup>1</sup> Indicates a credit.<sup>2</sup> Credit under trestles in May is due to material, already charged into the work, being returned to quartermaster's department.

TABLE 8.—Concrete piling foundations.  
ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>GATUN LOCKS.</b>													
Preparing foundations, concrete piling, linear feet.....										2,544	5,424	228	8,196
Concrete piles in place.....										\$1.6712	\$1.9814	\$10.5473	\$2,1234
Maintenance of equipment.....										.0061	.0291	.7611	.0679
Division expenses.....										.0050	.0115	.4125	.0207
Total division cost.....										1.7023	2.0220	11.7209	2.2120
Administrative and general expenses.....										.0094	.0369	1.1339	.0775
Total cost.....										1.8317	2.0590	12.8548	2.2895

TABLE 9.—Stone production.  
ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>PORTO BELLO QUARRY.</b>													
Quarrying..... cubic yards.....	62,996	74,925	69,733	78,080	66,699	80,244	84,072	72,242	87,109	68,746	58,483	60,704	864,033
Stripping.....	\$0.0317	\$0.0355	\$0.0264	\$0.0197	\$0.0218	\$0.0133	\$0.0096	\$0.0078	\$0.0072	\$0.0259	\$0.0173	\$0.0029	\$0.0174
Drilling.....	.0714	.0568	.0554	.0475	.0555	.0370	.0381	.0405	.0315	.0375	.0376	.0355	.0350
Blasting.....	.3632	.2915	.2262	.2109	.1932	.1625	.1520	.1499	.1437	.1373	.1310	.1701	.1980
Loading.....	.1344	.1221	.1218	.0655	.0658	.0709	.0667	.0845	.0853	.0728	.0812	.0803	.0921
Transportation.....	.1031	.0875	.0886	.0778	.0946	.0706	.0682	.0720	.0572	.0613	.0693	.0666	.0758
Tracks.....	.0582	.0423	.0811	.0399	.0468	.0619	.0382	.0383	.0272	.0220	.0727	.0400	.0484
Power.....	.0386	.0382	.0383	.0384	.0398	.0234	.0360	.0190	.0191	.0197	.0244	.0223	.0298
Maintenance of equipment.....	.1258	.1399	.1088	.1058	.0952	.1314	.0735	.0801	.0540	.0542	.0645	.1189	.0981
Plant arbitrary.....	.3401	.3401	.3401	.3400	.3401	.3401	.3300	.3300	.3300	.3300	.3300	.3300	.3350
Total.....	1.2665	1.1539	1.0877	.9635	.9758	.9210	.8433	.8281	.7382	.7607	.9080	.8666	.9367
<b>Crushing..... cubic yards.....</b>	62,996	74,925	69,733	78,080	66,699	80,244	84,072	72,242	87,109	68,746	58,483	60,704	864,033
Operation, crushers.....	\$0.0490	\$0.0469	\$0.0462	\$0.0424	\$0.0557	\$0.0339	\$0.0222	\$0.0259	\$0.0224	\$0.0246	\$0.0300	\$0.0266	\$0.0355
Stone bins and conveyers.....	.0375	.0308	.0423	.0372	.0468	.0263	.0274	.0244	.0384	.0219	.0208	.0165	.0311
Power.....	.0361	.0404	.0416	.0385	.0325	.0230	.0389	.0417	.0410	.0421	.0322	.0478	.0394

## EXHIBIT B.—DETAILED COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 9.—Stone production—Continued.

ATLANTIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>PORTO BELLO QUARRY—continued.</b>													
Crushing—Continued.....cubic yards.													
Maintenance of equipment.....	.0918	.1010	.1253	.1017	.1504	.1340	.1038	.1033	.1387	.1219	.1038	.0939	.1138
Plant arbitrary.....	.1751	.1751	.1751	.1751	.1751	.1751	.1700	.1700	.1700	.1700	.1700	.1700	.1726
<b>Total.....</b>	<b>.3669</b>	<b>.3642</b>	<b>.4006</b>	<b>.3949</b>	<b>.4086</b>	<b>.3943</b>	<b>.3623</b>	<b>.3632</b>	<b>.4115</b>	<b>.3798</b>	<b>.3659</b>	<b>.3546</b>	<b>.3944</b>
<b>Total cost production.....</b>	<b>1.0560</b>	<b>1.5481</b>	<b>1.5182</b>	<b>1.3584</b>	<b>1.4453</b>	<b>1.3153</b>	<b>1.2056</b>	<b>1.1933</b>	<b>1.1497</b>	<b>1.1405</b>	<b>1.2939</b>	<b>1.2212</b>	<b>1.3311</b>
<b>Towing.....cubic yards.</b>	<b>62.996</b>	<b>74.925</b>	<b>69.733</b>	<b>78.080</b>	<b>66.699</b>	<b>80.244</b>	<b>84.072</b>	<b>72.242</b>	<b>87.109</b>	<b>68.746</b>	<b>58.483</b>	<b>60.704</b>	<b>864.033</b>
Operation, tugs and barges.....	\$0.1437	\$0.1276	\$0.1214	\$0.1235	\$0.1785	\$0.1918	\$0.1920	\$0.1553	\$0.1572	\$0.1533	\$0.1675	\$0.1594	\$0.1592
Maintenance of equipment.....	.0358	.0476	.0455	.0326	.1106	.1042	.2218	.1378	.0881	.1345	.1713	.1400	.1063
Plant arbitrary.....	.2240	.2240	.2239	.2240	.2240	.2240	.1710	.1710	.1710	.1710	.1710	.1710	.1975
<b>Total.....</b>	<b>.4035</b>	<b>.3992</b>	<b>.3908</b>	<b>.3851</b>	<b>.5131</b>	<b>.5200</b>	<b>.5848</b>	<b>.4639</b>	<b>.4163</b>	<b>.4688</b>	<b>.5098</b>	<b>.4794</b>	<b>.4930</b>
<b>Unloading.....cubic yards.</b>	<b>62.996</b>	<b>74.925</b>	<b>69.733</b>	<b>78.080</b>	<b>66.699</b>	<b>80.244</b>	<b>84.072</b>	<b>72.242</b>	<b>87.109</b>	<b>68.746</b>	<b>58.483</b>	<b>60.704</b>	<b>864.033</b>
Operation, cableways and cranes.....	\$0.1347	\$0.0973	\$0.1138	\$0.1179	\$0.1277	\$0.1172	\$0.1274	\$0.1286	\$0.0953	\$0.1033	\$0.1086	\$0.1300	\$0.1108
Power.....	.0218	.0185	.0206	.0186	.0215	.0180	.0216	.0219	.0187	.0184	.0212	.0181	.0196
Track repairs.....	.0042	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dumping.....	.0668	.1122	.0145	.1419	.0629	.1028	.1446	.1054	.0275	.0627	.1180	.1066	.0629
Maintenance of equipment.....	.0660	.1122	.0145	.1419	.0629	.1028	.1446	.1054	.0275	.0627	.1180	.1066	.0629
Plant arbitrary.....	.2030	.2030	.2029	.2029	.2030	.2030	.2070	.2070	.2070	.2070	.2070	.2070	.2050
<b>Total.....</b>	<b>.5225</b>	<b>.4350</b>	<b>.3518</b>	<b>.4813</b>	<b>.4354</b>	<b>.4390</b>	<b>.5006</b>	<b>.4029</b>	<b>.3455</b>	<b>.3974</b>	<b>.4548</b>	<b>.4007</b>	<b>.4342</b>
<b>Rail transportation to storage, cubic yards.</b>	<b>31.268</b>	<b>27.191</b>	<b>29.808</b>	<b>29.808</b>	<b>23.656</b>	<b>26.183</b>	<b>27.392</b>	<b>19.702</b>	<b>23.248</b>	<b>24.115</b>	<b>20.996</b>	<b>21.529</b>	<b>275.148</b>
Operation of trains.....	\$0.0669	\$0.0669	\$0.0669	\$0.0669	\$0.0574	\$0.0666	\$0.0650	\$0.0680	\$0.0590	\$0.0736	\$0.1107	\$0.0992	\$0.0819
Repairs to tracks.....	.....	.0660	.0103	.0238	.0238	.0223	.0221	.0169	.0110	.0146	.0137	.0129	.0142
Dumping in storage.....	.0094	.0094	.0096	.0096	.0094	.0096	.0096	.0096	.0096	.0096	.0096	.0096	.0136
Maintenance of equipment.....	.0246	.0246	.0246	.0246	.0246	.0246	.0246	.0246	.0246	.0246	.0246	.0246	.0246
<b>Total.....</b>	<b>.0921</b>	<b>.1702</b>	<b>.2043</b>	<b>.2043</b>	<b>.1369</b>	<b>.1809</b>	<b>.1441</b>	<b>.1822</b>	<b>.1466</b>	<b>.1711</b>	<b>.1971</b>	<b>.1822</b>	<b>.1788</b>
<b>Division expense.....</b>	<b>.1134</b>	<b>.1145</b>	<b>.0963</b>	<b>.0768</b>	<b>.0509</b>	<b>.0360</b>	<b>.0312</b>	<b>.0240</b>	<b>.0287</b>	<b>.0281</b>	<b>.0307</b>	<b>.0337</b>	<b>.0651</b>
<b>Total cost in storage.....</b>	<b>2.0654</b>	<b>2.3332</b>	<b>2.4265</b>	<b>2.3798</b>	<b>2.4034</b>	<b>2.3694</b>	<b>2.3693</b>	<b>2.1971</b>	<b>1.9793</b>	<b>2.1148</b>	<b>2.3600</b>	<b>2.2596</b>	<b>2.3403</b>

## PACIFIC DIVISION.

ANCON QUARRY.													
Quarrying..... cubic yards.													
Stripping.....	\$0.0317	\$0.0130	\$0.0105	\$0.0196	\$0.0241	\$0.0281	\$0.0060	\$0.0683	\$0.1078	\$0.1010	\$0.0684	\$0.0442	1855, 824
Drilling.....	.0604	.0550	.0464	.0393	.0561	.0390	.0510	.0444	.0486	.0472	.0315	.0318	\$0.0476
Blasting.....	.0637	.0425	.0288	.0626	.0465	.0310	.0378	.0764	.0378	.0364	.0437	.0438	.0440
Loading.....	.0842	.0416	.0476	.0313	.0435	.0546	.0504	.0449	.0841	.0477	.0462	.0347	.0482
Transportation.....	.1026	.0573	.0601	.0762	.0800	.0796	.0672	.0609	.0857	.0656	.0605	.0568	.0727
Trucks.....	.1020	.0277	.0277	.0447	.0147	.0274	.0274	.0268	.0235	.0355	.0268	.0347	.0843
Maintenance of equipment.....	* .0607	.0248	.0377	.0471	.0226	.0509	.0603	.0745	.0112	.0616	.0552	.0324	.0638
Plant arbitrary.....	.2500	.2500	.2500	.2500	.2500	.2500	.2400	.2400	.2400	.2400	.2400	.2400	.2447
Total.....	.6329	.5046	.5088	.5638	.5375	.5419	.6296	.6857	.6539	.6670	.5896	.5384	.5548
Crushing..... cubic yards.													
Operation, crushers.....	\$0.0225	\$0.0184	\$0.0174	\$0.0156	\$0.0164	\$0.0182	\$0.0244	\$0.0185	\$0.0196	\$0.0225	\$0.0200	\$0.0164	\$0.0172
Stone bins and conveyers.....	.0077	.0059	.0056	.0044	.0044	.0050	.0052	.0051	.0055	.0054	.0051	.0037	.0045
Power.....	.0382	.0359	.0173	.0183	.0157	.0175	.0190	.0161	.0166	.0147	.0205	.0207	.0188
Maintenance of equipment.....	.0027	.0053	.0011	.0060	.0105	.0075	.0055	.0076	.0190	.0332	.0292	.0643	.0176
Plant arbitrary.....	.0797	.0795	.0787	.0780	.0786	.0796	.0754	.0746	.0745	.0740	.0752	.0747	.0762
Total.....	.1508	.1450	.1201	.1272	.1256	.1280	.1586	.1219	.1352	.1486	.1501	.1768	.1337
Total cost of production.....	.7837	.6496	.6289	.6910	.6631	.6699	.7891	.8076	.7861	.8108	.7399	.7182	.6885
Rail transportation to storage, cubic yards.													
Operation of trains.....	\$0.0550	\$0.0502	\$0.0328	\$0.0513	\$0.0573	\$0.0637	\$0.0531	\$0.0522	\$0.0381	\$0.0379	\$0.0377	\$0.0423	\$0.0447
Repairs to tracks.....	.0184	.0120	.0119	.0110	.0105	.0118	.0151	.0181	.0096	.0081	.0065	.0023	.0075
Dumping in storage.....	.0060	.0096	.0119	.0114	.0116	.0088	.0133	.0131	.0098	.0081	.0098	.0104	.0098
Maintenance of equipment.....	.0179	.0134	.0136	.0217	.0136	.0210	.0220	.0210	.0200	.0061	.0136	.0274	.0176
Plant arbitrary.....	.0600	.0500	.0500	.0500	.0500	.0500	.0600	.0600	.0600	.0600	.0600	.0600	.0653
Total.....	.1503	.1351	.1402	.1454	.1430	.1491	.1577	.1513	.1336	.1121	.1276	.1424	.1330
Division expense.....	.0364	.0201	.0209	.0261	.0244	.0207	.0317	.0291	.0259	.0253	.0244	.0203	.0228
Total cost in storage.....	.9704	.8048	.7900	.8625	.8305	.8397	.9785	.9680	.9486	.9542	.9819	.8809	.8443

<sup>1</sup> Under "Total quantities" 82,432 cubic yards have been added to adjust the difference between cross section measurements of stock pile and book balance. This amount has not been added to monthly quantities.

<sup>2</sup> Indicates a credit.

## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 10.—*Sand production.*

## ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>NOMBRE DE DIOS.</b>													
Excavation.....cubic yards.....	10,818	12,955	5,730	36									29,539
Blasting.....	\$0.0513	\$0.0015											\$0.0194
Loading by cranes.....	.1790	.1966	\$0.2290	\$0.4406									\$0.2091
Trucks.....	.1445	.1279	.0466	4.9054									.1238
Transportation.....	.1110	.0905	.0628	9.3256									.1033
Trestles.....	.0178	.0021	.0128	25.9439									.0416
Dumps.....	.0114	.0130											.0099
Pumps.....	.0288	.0148	.0779	2.6192									.0354
Maintenance of equipment.....	.1383	.2070	.1286	11.4315									.2560
Total.....	.6831	.6466	.5774	63.6722									.7975
Dredging.....cubic yards.....	14,208	16,067	27,652	44,655	45,375	42,092	28,994	33,412	47,885	47,801	40,003	24,236	412,380
Operation, dredges.....	\$0.3327	\$0.4713	\$0.3277	\$0.2233	\$0.2473	\$0.1940	\$0.2820	\$0.2687	\$0.1948	\$0.1548	\$0.2188	\$0.3067	\$0.2444
Maintenance of equipment.....	.2776	.4744	.2897	.2316	.0629	.0894	.0645	.0235	.0278	.0126	.0065	.0638	.1010
Total.....	.6103	.9457	.6174	.4549	.3102	.2834	.3365	.2922	.2226	.1677	.2273	.3595	.3454
Plant arbitrary.....	.4670	.4680	.4680	.4680	.4680	.4680	.4900	.4900	.4900	.4900	.4900	.4900	.4740
Quantity produced.....cubic yards.....	25,026	29,022	33,382	44,691	45,375	42,092	28,994	33,412	47,885	47,801	40,003	24,236	441,919
Total cost of production.....	\$1.1068	\$1.2802	\$1.0837	\$0.9738	\$1.0789	\$0.7514	\$0.8228	\$0.8214	\$0.7188	\$0.6477	\$0.6945	\$0.8395	\$0.8496
Towing.....cubic yards.....	25,026	29,022	33,382	44,691	45,375	42,092	28,994	33,412	47,885	47,801	40,003	24,236	441,919
Operation, tugs and barges.....	\$0.2673	\$0.2481	\$0.1817	\$0.1923	\$0.1708	\$0.2355	\$0.2439	\$0.2540	\$0.1747	\$0.1875	\$0.1806	\$0.2380	\$0.2084
Maintenance of equipment.....	.0902	.0649	.0867	.0435	.0424	.0984	.1963	.1561	.1146	.1407	.1899	.1707	.1130
Plant arbitrary.....	.2310	.2309	.2310	.2310	.2310	.2310	.2110	.2110	.2110	.2110	.2110	.2110	.2209
Total.....	.5785	.5539	.4994	.4668	.4442	.5650	.6835	.6311	.5003	.5392	.5725	.6197	.5423

Unloading..... cubic yards.....	25, 026	29, 022	33, 383	44, 061	45, 375	42, 092	26, 994	33, 412	47, 885	47, 801	40, 008	24, 236	441, 919
Operation, cableways and cranes.....	\$0. 1350	\$0. 1009	\$0. 1136	\$0. 1224	\$0. 1229	\$0. 1260	\$0. 1226	\$0. 1338	\$0. 0955	\$0. 1114	\$0. 1118	\$0. 1419	\$0. 1189
Power.....	.0353	.0196	.0185	.0246	.0196	.0159	.0171	.0154	.0346	.0162	.0192	.0157	.0188
Maintenance of equipment.....	.0854	.0667	.0220	.0784	.0778	.0697	.1224	.1211	.0138	.0571	.1104	.1045	.0782
Plant arbitrary.....	.1370	.1370	.1370	.1370	.1370	.1370	.1620	.1620	.1620	.1620	.1620	.1620	.1496
Total.....	.3932	.3241	.2961	.3634	.3572	.3686	.4241	.4323	.3068	.3467	.4034	.4241	.3655
Rail transportation to storage, cubic yards.....			13, 040	9, 335	19, 042	21, 170	10, 769	14, 656	16, 509	12, 133	17, 517	11, 967	157, 997
Operation of trains.....		\$0. 1906	\$0. 1022	\$0. 1254	\$0. 0374	\$0. 0696	\$0. 0650	\$0. 0879	\$0. 0691	\$0. 1342	\$0. 1107	\$0. 1034	\$0. 0882
Repairs to tracks.....			.0051	.0213	.0238	.0223	.0221	.0170	.0110	.0265	.0137	.0134	.0163
Dumping in storage.....		.0006	.0005	.0006	.0004								.0002
Maintenance of equipment.....		.0708	.0699	.1196	.0653	.0690	.0970	.0903	.0765	.1432	.0727	.0732	.0787
Total.....		.2920	.1747	.2669	.1369	.1809	.1441	.1952	.1466	.3039	.1971	.1900	.1934
Division expense.....		.0846	.0670	.0475	.0161	.0116	.0145	.0103	.0068	.0061	.0065	.0125	.0299
Total cost in storage.....		2. 1651	1. 9844	1. 9074	1. 6599	1. 7877	1. 0683	1. 9707	1. 5827	1. 6168	1. 7632	1. 9895	1. 8665

1 Dry excavation was discontinued in October, but small charges and credits to that account were made in the months of November, January, February, March, and May. As no yardage was accomplished, no unit costs are shown, and cost of dredging, plus plant charge, does not equal total cost of production.

## PACIFIC DIVISION.

CHAMBER.....													
Dredging..... cubic yards.....	36, 299	40, 277	42, 500	41, 035	43, 161	42, 520	41, 130	36, 272	41, 878	36, 663	35, 903	38, 964	1, 494, 841
Operation, dredges.....	\$0. 0981	\$0. 0962	\$0. 0776	\$0. 0811	\$0. 0755	\$0. 0720	\$0. 0973	\$0. 0947	\$0. 1262	\$0. 1265	\$0. 1091	\$0. 1170	\$0. 0926
Maintenance of equipment.....	.0185	.0446	.0466	.0380	.0680	.0199	.0434	.0270	.0321	.0464	.0255	.0338	.0354
Total.....	.1166	.1308	.1271	.1191	.1335	.0919	.1407	.1217	.1583	.1729	.1346	.1508	.1280
Plant arbitrary.....	.0300	.0300	.0300	.0300	.0300	.0300	.0300	.0300	.0300	.0300	.0300	.0300	.0300
Total cost of production.....	.1466	.1608	.1571	.1491	.1635	.1219	.1707	.1517	.1883	.2029	.1646	.1808	.1580
Towing..... cubic yards.....	36, 299	40, 277	42, 500	41, 035	43, 161	42, 520	41, 130	36, 272	41, 878	36, 663	35, 903	38, 964	494, 841
Operation, tugs and barges.....	\$0. 0940	\$0. 1012	\$0. 1188	\$0. 1068	\$0. 1281	\$0. 0651	\$0. 1237	\$0. 1346	\$0. 0665	\$0. 1213	\$0. 1238	\$0. 1085	\$0. 1067
Maintenance of equipment.....	.0302	.0222	.0160	.0845	.1425	.0760	.0278	.1015	.0609	.0953	.0134	.0453	.0653
Plant arbitrary.....	.0600	.0600	.0600	.0600	.0600	.0600	.0700	.0700	.0700	.0700	.0700	.0700	.0649
Total.....	.1842	.1844	.1840	.2503	.3306	.2211	.2215	.3063	.2174	.2666	.2072	.2238	.2299

## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 10.—*Sand production*—Continued.

## PACIFIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>CHAME—continued.</b>													
Unloading.....cubic yds.	36,299	40,277	42,500	41,035	43,161	42,520	41,130	36,272	41,878	36,663	35,903	38,964	494,841
Operation, cableways and cranes.....	\$0.0437	\$0.0549	\$0.0412	\$0.0521	\$0.0431	\$0.0480	\$0.0591	\$0.0702	\$0.0606	\$0.0594	\$0.0630	\$0.0729	\$0.0532
Power.....	.0392	.0427	.0017	.0373	.0286	.0244	.0325	.0310	.0310	.0313	.0308	.0273	.0284
Maintenance of equipment.....	.0581	.0536	.0888	.0557	.0519	.0496	.0823	.0671	.0905	.0603	.0417	.0383	.0599
Plant arbitrary.....	.1100	.1113	.1089	.1094	.1088	.1089	.1048	.1046	.1043	.1044	.1040	.1032	.1067
Total.....	.2510	.2625	.2416	.2575	.2294	.2309	.2787	.2748	.2803	.2653	.2385	.2417	.2432
<b>Rail transportation to storage, cubic yards.</b>													
Operation of trains.....	21,316	37,524	41,647	40,250	43,161	42,520	41,130	36,257	41,848	36,663	35,903	38,954	475,422
Repairs to tracks.....	\$0.0473	\$0.0478	\$0.0520	\$0.0552	\$0.0422	\$0.0445	\$0.0448	\$0.0493	\$0.0469	\$0.0487	\$0.0517	\$0.0473	\$0.0462
Dumping in storage.....	.0132	.0114	.0112	.0089	.0079	.0127	.0336	.0167	.0234	.0275	.0376	.0423	.0197
Maintenance of equipment.....	.0130	.0203	.0158	.0186	.0108	.0133	.0118	.0225	.0095	.0065	.0123	.0131	.0134
Plant arbitrary.....	.0154	.0129	.0144	.0261	.0117	.0109	.0138	.0200	.0319	.0079	.0195	.0311	.0174
Total.....	.0900	.0900	.0900	.0918	.0900	.0884	.0800	.0800	.0800	.0800	.0800	.0800	.0849
Total.....	.1789	.1824	.1834	.2006	.1626	.1688	.1840	.1885	.1917	.1706	.2011	.2138	.1316
Division expense.....	.0214	.0306	.0237	.0332	.0307	.0173	.0273	.0153	.0126	.0131	.0152	.0160	.0208
Total cost in storage.....	.7841	.8207	.7948	.8807	.9168	.7610	.8822	.9366	.8963	.9885	.8966	.8761	.8984

<sup>1</sup> Under "Total quantities," 18,249 cubic yards have been added to adjust the difference between cross-section measurement of stock pile and book balance. This amount has not been added to monthly quantities.

## EXHIBIT B—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911.—Continued.

TABLE 11.—*Concrete pile manufacture—Atlantic division.*

Items.	Mar.	Apr.	May.	June.	Total.
Quantities.....linear feet..	9,394	10,002	5,904	5,760	31,060
Cement.....	\$0.0997	\$0.1024	\$0.0828	\$0.0760	\$0.0930
Stone.....	.0556	.0780	.1176	.1145	.0846
Sand.....	.0169	.0178	.0255	.0080	.0172
Mixing.....	.0396	.0358	.1157	.0612	.0549
Placing.....	.0295	.0334	.0711	.0323	.0392
Reenforcements.....	.4840	.8584	.7276	.6346	.7000
Forms.....	.1543	.0922	.6344	.0786	.1030
Maintenance of equipment.....		.0053	.9054	.0114	.0058
Plant arbitrary.....	.1600	.1794	.1790	.1700	.1700
Division expense.....	.0165	.0114	.9170	.0210	.0158
Total division cost.....	1.0561	1.4111	1.3671	1.1976	1.2835



## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 12.—Operation power plants.

## ATLANTIC DIVISION.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>GATUN POWER PLANT.</b>													
Output... kilowatt hours...	815,040	789,327	583,070	650,220	903,610	1,152,280	1,006,220	1,229,190	1,461,970	1,294,810	1,536,380	1,530,130	12,982,247
Operation.....	\$0.0051	\$0.0039	\$0.0055	\$0.0044	\$0.0030	\$0.0027	\$0.0027	\$0.0023	\$0.0018	\$0.0022	\$0.0017	\$0.0015	\$0.0027
Fuel.....	.0091	.0088	.0086	.0090	.0076	.0064	.0060	.0071	.0080	.0081	.0075	.0079	.0080
Repairs to equipment..	.0008	.0013	.0007	.0015	.0008	.0015	.0002	.0011	.0011	.0013	.0007	.0010	.0007
Plant arbitrary.....	.0110	.0110	.0110	.0110	.0110	.0110	.0111	.0111	.0110	.0110	.0110	.0110	.0110
Division expense.....	.0005	.0006	.0006	.0006	.0003	.0002	.0002	.0001	.0002	.0002	.0001	.0001	.0003
Total.....	.0285	.0255	.0274	.0274	.0216	.0218	.0222	.0196	.0221	.0228	.0210	.0215	.0227

1 Indicates a credit.

## PACIFIC DIVISION.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
<b>MIRAFLORES POWER PLANT.</b>													
Output... kilowatt hours...	161,930	201,140	371,324	688,870	668,250	703,790	796,880	757,150	770,060	557,280	569,700	578,370	6,797,714
Operation.....	\$0.0164	\$0.0133	\$0.0064	\$0.0035	\$0.0038	\$0.0038	\$0.0031	\$0.0034	\$0.0036	\$0.0049	\$0.0043	\$0.0041	\$0.0045
Fuel.....	.0157	.0129	.0076	.0062	.0066	.0066	.0062	.0061	.0072	.0084	.0102	.0092	.0090
Repairs to equipment..	.0043	.0029	.0044	.0108	.0016	.0016	.0015	.0016	.0019	.0020	.0027	.0073	.0034
Plant arbitrary.....	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
Division expense.....	.0016	.0011	.0006	.0005	.0005	.0003	.0004	.0004	.0003	.0004	.0004	.0004	.0006
Total.....	.0480	.0402	.0280	.0340	.0255	.0232	.0232	.0244	.0230	.0237	.0276	.0310	.0274

## EXHIBIT B.—DETAIL COST PER UNIT OF WORK, FISCAL YEAR 1911—Continued.

TABLE 13.—*Lighting and buoying canal.*

Items.	Quantity of work done.	Amount.	Unit cost.
Surveys.....	67,550 feet.....	\$1,863.71	\$0.0282
Clearing.....	373.5 acres.....	9,130.09	24.4466
Division expense.....		1,062.06	
Total division cost.....		12,055.85	
Administrative and general expense.....		2,319.03	
Total cost.....		14,374.88	

TABLE 14.—*Hydraulic filling in city of Colon.*

Items.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Hydraulic filling, cubic yards	66,287	97,731	112,841	70,826	84,948	92,361	76,501	97,149	698,644
Surveys.....	\$0.0019	\$0.0012	\$0.0018	\$0.0026	\$0.0007	\$0.0011	\$0.0019	\$0.0013	\$0.0015
Pipe-line dredges:									
Operation.....	.1333	.1365	.0748	.1685	.0949	.1232	.1205	.1150	.1260
Repairs.....	.0449	.0394	.0064	.0054	.0001	.0065	.0119	.0067	.0147
Pipe lines, dikes, etc.....	.1266	.0689	.0221	.0136	.0829	.0427	.0129	.0059	.0431
Division expense.....	.0106	.0082	.0037	.0041	.0030	.0045	.0044	.0051	.0054
Total division cost.....	.3173	.2442	.1088	.1942	.1816	.1780	.1516	.1340	.1856
Administrative and general expense.....	.0400	.0379	.0170	.0247	.0216	.0240	.0152	.0186	.0252
Total cost.....	.3573	.2821	.1258	.2189	.2032	.2020	.1668	.1526	.2108

## EXHIBIT C.—PERFORMANCE OF ROCK CRUSHING PLANTS AND OF CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1911.

TABLE 1.—Performance Porto Bello rock crushers, fiscal year 1910-11.

## ATLANTIC DIVISION.

Months.	Rock crushed.	Service time.										Quantity crushed.		Per cent of work- ing time to total time under pay.
		Hours working.	Delays.						Total hours under pay.	Per work- ing hour.	Cu. yds.			
			Repairs to crushers.	Repairs to convey- ers.	Repairs to bin convey- ers.	Waiting on cars.	Crusher choked.	Waiting on barges.				Other delays.		
	Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Cu. yds.	Cu. yds.		
July.....	62,996	277.10	28.87	21.95	3.62	23.53	2.02	33.50	17.41	408.00	227.34	154.40	67.92	
August.....	74,925	301.87	13.40	18.50	11.30	23.62	3.53	36.33	22.95	432.00	248.20	173.44	69.87	
September.....	69,733	232.47	10.85	42.05	5.58	16.18	16.17	12.00	30.70	356.00	290.97	195.87	66.80	
October.....	78,080	237.51	5.85	3.10	13.87	22.77	3.00	10.75	15.15	312.00	328.74	250.25	76.13	
November.....	66,699	194.98	.58	.....	7.40	9.33	1.13	36.88	37.70	288.00	342.08	231.59	67.70	
December.....	80,244	241.18	.42	.....	7.67	17.47	2.26	31.60	10.70	312.00	332.71	257.19	77.30	
January.....	84,072	202.06	.48	.....	28.73	12.18	1.47	8.92	13.87	272.00	416.14	309.09	74.28	
February.....	72,242	183.40	.....	.....	6.33	12.26	2.47	14.50	5.32	208.00	442.12	347.32	78.56	
March.....	87,109	188.43	.....	.....	1.10	8.65	2.35	3.43	11.12	216.00	462.29	408.28	87.24	
April.....	68,746	193.16	1.65	4.70	1.47	13.10	.25	.88	6.79	192.00	421.34	398.05	84.93	
May.....	58,483	147.06	.67	.....	.18	38.05	3.53	.....	18.20	208.00	397.62	281.16	70.71	
June.....	60,704	180.03	.....	.....	.88	50.12	.92	13.62	12.43	208.00	466.85	291.85	62.51	
Total.....	864,083	2,479.24	62.77	99.96	88.13	247.46	39.69	202.41	192.34	3,412.00	348.51	263.23	72.66	
Per cent of total.....	.....	72.66	1.84	2.93	2.58	7.25	1.17	5.93	5.64	100.00	.....	.....	.....	

NOTE.—Prior to Sept. 6, 1910, the plant consisted of 2 No. 9 and 4 No. 6 crushers; on that date 1 No. 21 was put in operation. The plant was operated 16 hours from July 1 to Sept. 17; 12 hours from Sept. 18 to Jan. 15, 10 hours from Jan. 16 to Feb. 14, and 8 hours from Feb. 15 to June 30.

TABLE 2.—Performance of unloading cableways for fiscal year ended June 30, 1911.

[Plant consists of 3 cableways—two 2-strand, one 1-strand.]

## ATLANTIC DIVISION.

Months.	Average number strands operated.	Material handled.	Service time.						Average quantity handled per strand.		Per cent of working time to total time under pay.
			Hours working.	Delays.				Hours under pay per month.	Per hour working.	Per hour under pay.	
				Repairs.	Electrical delays.	Waiting on barges.	Other delays.				
		Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Cu. yds.	Cu. yds.		
July.....	5.00	63,336	1,449.58	405.65	102.58	438.03	604.15	1,550.41	43.69	21.11	43.32
August.....	5.00	60,228	1,357.45	238.80	153.78	790.83	490.14	1,668.55	43.41	19.71	45.40
September.....	4.85	56,830	1,331.53	518.97	174.97	400.45	449.08	1,543.47	41.14	19.43	47.23
October.....	5.00	64,566	1,592.15	286.10	115.74	715.98	337.03	1,487.85	40.55	20.96	51.89
November.....	5.00	57,496	1,420.57	281.98	60.40	628.68	410.37	1,379.43	40.47	20.53	60.73
December.....	5.00	68,409	1,670.35	496.17	86.65	616.68	251.15	1,449.65	3,120.00	21.93	53.54
January.....	5.00	71,327	1,788.57	254.92	51.20	423.67	521.65	1,251.44	39.87	23.46	58.88
February.....	5.00	62,065	1,463.43	144.96	58.94	623.15	197.53	1,224.57	42.41	23.09	54.44
March.....	5.00	76,365	1,711.10	276.93	56.50	869.40	336.07	1,528.90	44.63	23.57	52.81
April.....	5.00	65,513	1,440.80	247.53	104.55	869.79	208.33	1,431.20	45.47	22.80	50.17
May.....	5.00	52,194	1,126.45	424.62	81.53	1,017.15	238.25	1,761.55	46.33	18.07	39.00
June.....	5.00	44,079	927.78	290.68	62.68	920.64	206.22	1,489.22	47.51	18.31	38.53
Total.....	5.00	742,408	17,356.76	3,850.30	1,114.52	8,501.45	4,280.97	17,757.24	42.77	21.14	49.43
Per cent of total.....			49.43	10.97	3.17	24.21	12.22	50.57			

NOTE.—These cableways were operated with 3 shifts per day, or 24 hours throughout the year.



TABLE 4.—*Performance of construction plant mixers, Gatun Locks, fiscal year 1910-11.*

[Plant consists of a battery of eight 2-yard mixers.]

## ATLANTIC DIVISION.

Months.	Average number of mixers.	Concrete mixed. <sup>1</sup>	Service time.					Average quantity of concrete mixed.		Per cent of working time to total time under pay.
			Hours working.	Delays.			Hours under pay per month.	Per hour working.	Per hour under pay.	
				Repairs to mixers.	Waiting for cars.	Other delays.				
			Hours.	Hours.	Hours.		Cubic yards.	Cubic yards.		
July.....	6.00	54,822	1,865.08	517.42	127.17	2,510.67	28.85	21.84	74.33	
August.....	6.00	54,984	1,992.17	697.83	27.00	2,687.00	28.81	20.46	73.02	
September.....	7.00	44,328	1,713.14	308.03	37.92	2,149.40	26.80	20.62	79.94	
October.....	6.00	45,656	969.80	60	19.51	1,033.81	50.68	25.55	50.41	
November.....	6.26	46,542	788.42	.72	15.17	1,750.89	59.29	26.56	44.86	
December.....	6.27	46,313	834.17	11.73	34.61	1,731.42	59.12	26.15	47.63	
January.....	6.20	53,840	921.26	11.73	800.48	1,733.47	58.44	31.06	53.15	
February.....	6.17	54,517	928.20	800.48	783.20	1,690.40	58.73	32.26	54.91	
March.....	6.04	63,272	1,076.53	842.41	711.25	1,921.94	58.59	32.91	56.17	
April.....	5.75	46,812	836.48	745.02	711.25	1,547.73	58.55	32.18	54.05	
May.....	5.61	46,627	797.78	763.83	763.83	1,542.80	58.43	28.38	48.56	
June.....	5.69	36,158	641.22	763.83	763.83	1,405.15	56.26	25.59	45.63	
Total.....										
Per cent of total.....	6.08	602,851	13,330.25	1,536.33	281.38	22,694.68	45.22	26.56	58.74	
			58.74	6.77	1.15	100.00				

<sup>1</sup> Indicates bucket measurement.

EXHIBIT C.—PERFORMANCE OF ROCK CRUSHING PLANTS AND OF CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1911—Contd.  
 TABLE 5.—Performance of auxiliary mixers, Gatun Locks, fiscal year 1910-11.

[Plant consists of two 2-cubic-yard mixers.]

ATLANTIC DIVISION.

Months.	Average number of mixers.	Concrete mixed. <sup>1</sup>	Hours working.	Service time.				Average quantity of concrete mixed.		Per cent of working time to total time under pay.
				Delays.			Hours under pay per month.	Per hour working.	Per hour under pay.	
				Repairs to mixers.	Waiting for cars.	Other delays.				
July.....	2	24,837	302.35	1.90	95.49	412.83	Cubic yards.	66.32	73.24	
August.....	2	22,723	332.87	2.09	105.13	454.50	68.26	49.99	73.24	
September.....	2	24,901	331.98	5.17	144.64	496.00	75.27	50.39	66.93	
October.....	2	30,480	468.28	.....	114.44	624.00	62.42	48.83	78.25	
November.....	2	21,196	322.07	.....	129.50	455.67	65.81	46.52	70.68	
December.....	2	23,478	303.48	4.25	151.00	459.33	77.36	51.11	66.07	
January.....	2	13,040	215.42	15.08	203.67	441.67	60.54	29.52	48.77	
February.....	2	10,950	187.50	3.67	215.00	406.34	88	26.95	46.14	
March.....	2	16,620	227.17	.....	249.00	477.00	73.16	34.84	47.62	
April.....	2	12,337	196.17	.....	225.83	428.67	62.84	28.78	46.12	
May.....	2	14,466	217.08	.....	254.50	475.83	66.63	30.40	45.62	
June.....	2	13,358	188.20	17.66	222.20	441.66	70.97	30.24	42.61	
Total.....	2	226,476	3,312.57	49.82	2,110.40	5,573.50	68.37	40.63	59.43	
Per cent of total.....	.....	.....	59.43	0.89	37.86	1.82	.....	.....	.....	

<sup>1</sup> Bucket measurement.

TABLE 6.—Performance of lock cableways, fiscal year 1910-11.

[Plant consists of four duplex cableway towers.]

## ATLANTIC DIVISION.

Months.	Average number of strands.	Concrete and large rock placed.	Time working.			Delays.					Total time under pay.	Material handled per hour working time.	Per cent working time to total time under pay.
			Placing concrete and large rock.	Handling steel and forms.	Total.	Repairs to cableways.	Waiting for concrete.	Waiting for forms.	Moving.	Other delays.			
		Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Cu. yds.	
July.....	8	68,510	1,913.40	199.72	2,113.12	38.25	83.45	135.68	93.00	278.85	2,513.67	24.53	84.07
August.....	8	60,198	2,014.96	191.39	2,206.37	37.13	94.53	185.68	128.34	76.00	2,492.71	29.88	81.94
September.....	8	46,711	1,523.00	128.68	1,651.68	96.40	303.88	275.73	145.45	.....	2,462.13	31.77	87.36
October.....	8	52,215	1,698.78	162.52	1,861.30	130.20	92.60	311.91	125.08	.....	2,539.46	30.77	87.26
November.....	8	50,773	1,590.68	182.29	1,772.97	21.78	60.72	328.35	125.08	.....	2,538.90	31.92	78.79
December.....	8	53,113	1,575.13	261.14	1,836.27	59.45	69.52	404.88	141.21	.....	2,511.43	33.72	73.12
January.....	8	57,437	1,598.52	215.06	1,813.58	80.93	132.20	316.73	120.35	.....	2,463.81	35.93	73.61
February.....	8	53,568	1,330.81	162.28	1,493.09	28.47	90.52	342.37	120.33	.....	2,474.76	35.01	74.43
March.....	8	60,144	1,738.36	240.41	1,978.79	55.85	63.32	390.48	126.16	.....	2,613.60	34.60	76.07
April.....	8	47,372	1,378.07	243.88	1,621.95	93.12	61.78	399.71	146.37	.....	2,312.93	34.38	70.13
May.....	8	44,719	1,424.35	272.73	1,697.08	62.92	34.48	525.30	165.03	.....	2,484.81	31.40	68.30
June.....	8	29,871	1,008.98	337.88	1,346.79	313.32	39.03	623.77	111.84	.....	2,434.75	28.61	55.32
Total.....	8	616,661	19,003.03	2,608.96	21,692.99	1,018.02	1,131.03	4,064.93	1,423.16	354.85	29,616.96	32.45	72.96
Per cent of total.....			64.16	8.80	72.96	3.44	3.80	13.79	4.81	1.20	100.00	.....	.....



## EXHIBIT C.—PERFORMANCE OF ROCK CRUSHING PLANTS AND OF CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1911—Contd.

TABLE 7.—Performance of Ancon rock crushers, fiscal year 1910-11.

[Plant consists of four No. 6 and one No. 1 crusher.]

## PACIFIC DIVISION.

Months.	Stone crushed.	Hours working.	Service time.							Rate per hour.		Per cent of working time to total time under pay.
			Delays.					Total hours per month.	Working time.	Total time.		
			Repairs to crushers.	Crushers choked.	Bins full.	Waiting for rock.	Other delays.				Total delays.	
Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Cu. yds.	Cu. yds.				
July.....	43,230	137.58	13.75	8.42	17.50	.....	47.75	225.00	311.22	182.13	53.70	
August.....	61,002	183.64	10.25	13.63	8.70	.....	56.73	243.00	322.67	231.41	73.39	
September.....	58,244	165.66	21.94	6.29	3.90	.....	9.31	207.00	331.09	231.37	80.03	
October.....	92,065	191.12	7.36	12.30	3.34	.....	20.03	234.00	351.71	233.44	51.63	
November.....	64,130	174.75	6.34	16.19	7.60	.....	20.12	225.00	366.96	235.02	77.67	
December.....	79,669	231.20	9.75	17.73	.....	22.86	20.46	312.00	344.72	245.46	74.03	
January.....	73,829	225.24	12.74	17.13	2.01	10.09	32.74	301.00	323.55	244.43	73.09	
February.....	68,293	204.00	2.67	10.42	14.09	19.93	24.90	276.00	334.77	247.43	73.91	
March.....	87,921	240.10	23.31	13.33	10.67	16.82	20.67	324.00	334.77	271.36	74.10	
April.....	73,279	152.99	49.66	6.92	9.07	8.69	7.67	224.00	473.97	325.68	67.86	
May.....	73,893	170.49	7.09	10.09	10.82	6.25	26.26	224.00	433.42	315.73	72.87	
June.....	80,649	178.19	.33	9.53	13.25	12.09	13.56	234.00	452.60	344.55	70.15	
Total.....	866,824	2,254.96	155.09	141.98	102.85	95.72	288.40	3,039.00	379.33	281.61	74.20	
Per cent of total.....	.....	74.20	5.11	4.67	3.88	3.15	9.49	100.00	.....	.....	.....	

NOTE.—From Dec. 1 to Mar. 31, plant was operated 12 hours per day with one and one-half shifts; the balance of the time it was operated 9 hours per day with one shift.

TABLE 8.—Performance of sand unloading cranes, Balboa sand dock, fiscal year 1910-11.

[Plant consists of three electrically operated cranes.]

## PACIFIC DIVISION.

Months.	Average number of cranes working.	Sand un-loaded. <sup>1</sup>	Service time.										Rate per hour per crane.		Per cent of work-ing time to total time under pay.
			Hours working.	Delays.					Total hours per month.	Working time.	Total time.				
				Repairs to cranes.	Waiting for barges.	Waiting for cars.	Other delays.	Total delays.							
			Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Cu. yds.	Cu. yds.	Cu. yds.				
July.....	2	35,298	282 36	9 80	30 64	78 92	3 28	117 64	400 00	128 86	100 73	70 89			
August.....	2	46,277	301 28	41 84	57 14	15 34	15 53	114 15	416 48	183 89	86 72	72 86			
September.....	2	42,500	283 42	10 00	90 75	30 50	15 33	146 58	400 00	187 70	106 22	73 88			
October.....	2	46,432	311 50	9 00	108 20	32 00	1 00	147 20	416 00	177 73	111 69	64 62			
November.....	2	43,161	311 50	13 50	31 00	28 50	1 50	74 50	388 00	188 46	112 11	80 94			
December.....	2	42,520	297 00	10 50	57 00	61 50	5 00	124 00	421 00	148 16	101 00	70 47			
January.....	2	41,130	320 50	12 50	.....	70 00	.....	82 50	408 00	158 33	102 00	73 64			
February.....	2	36,272	254 00	2 00	.....	112 00	.....	114 00	398 00	142 80	98 57	69 00			
March.....	2	41,678	300 00	.....	.....	182 00	.....	182 00	432 00	139 89	86 46	69 44			
April.....	2	36,663	271 00	.....	.....	112 00	.....	112 00	384 00	132 50	86 46	71 49			
May.....	2	35,908	266 00	2 00	.....	114 00	14 00	130 00	416 00	132 58	86 51	68 76			
June.....	2	51,806	283 00	8 00	.....	125 00	.....	133 00	416 00	183 06	124 63	68 02			
Total.....	2	494,841	3,428 86	119.14	371.73	897.76	39.94	1,428.57	4,857.43	144.22	101.87	70.59			
Per cent of total.....	.....	.....	70.59	2.45	7.66	18.46	.82	29.41	100.00	.....	.....	.....			

<sup>1</sup> Bucket measurement.

NOTE.—Two cranes operated eight hours per day; one held in reserve.

EXHIBIT C.—PERFORMANCE OF ROCK CRUSHING PLANTS AND OF CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1911—Contd.,  
TABLE 9.—Performance of *berm cranes, Pedro Miguel Lock, fiscal year 1910-11.*

## PACIFIC DIVISION.

Months.	Number of cranes.	Number mixers (2 cubic yards).	Concrete mixed. <sup>1</sup>	Service time of mixers.							Rate per hour per mixer.		Per cent of working time to total time under pay.
				Hours working.	Delays.					Total hours per month.	Working time.	Total time.	
					Repairs to cranes.	Repairs to mixers.	Waiting for cars.	Other delays.	Total delays.				
July.....	2.00	4.00	Cu. yds. 34,880	630.50	40.50	Hours. 1.67	Hours. 214.16	Hours. 4.17	Hours. 299.50	Cu. yds. 55.33	Cu. yds. 38.76	70.16	
August.....	2.00	4.00	50,808	707.37	34.21	4.33	152.67	13.42	204.63	66.21	52.27	79.85	
September.....	2.00	4.00	49,852	683.09	15.30	24.08	170.00	10.53	217.91	72.98	55.21	75.63	
October.....	1.96	3.93	55,152	698.33	96.35	12.67	157.07	1.00	267.09	80.71	58.96	72.14	
November.....	2.00	4.00	49,568	622.82	45.75	3.50	181.27	8.83	239.35	79.59	57.49	72.24	
December.....	1.73	3.15	31,156	427.49	8.34		275.52	2.18	298.04	713.53	43.66	56.94	
January.....	1.72	2.76	35,640	477.42	12.66		131.99	6.84	156.49	583.91	61.04	73.14	
February.....	1.00	2.00	23,770	321.33	25.00	2.32	62.68	6.67	98.67	73.97	56.87	70.87	
March.....	1.00	2.00	25,704	396.51	13.67	1.50	103.16	11.16	129.49	64.83	48.87	75.28	
April.....	1.00	2.00	17,188	296.33	22.00	.67	105.50	7.50	135.67	58.00	39.79	68.59	
May.....	1.00	2.00	5,462	135.00	11.00		160.00		171.00	40.46	17.84	44.12	
June.....													
Total.....	1.58	3.08	379,190	5,394.19	333.78	55.74	1,714.02	72.30	2,175.84	70.30	50.09	71.26	
Per cent of total.....				72.40	4.44	.77	21.39	1.00	100.00				

<sup>1</sup> Bucket measurement.

TABLE 10.—Performance of barge cranes, Miraflores Locks, fiscal year 1910-11.

## PACIFIC DIVISION.

Months.	Num- ber of cranes.	Average number of mixers (2 cubic yards).	Concrete mixed. <sup>1</sup>	Service time of mixers.										Rate per hour per mixer.		Per cent of work- ing time to total time under pay.
				Hours working.	Delays.						Total hours per day.	Working time.	Total time.			
					Repairs to cranes.	Repairs to mixers.	Waiting for ma- terial.	Waiting for cars.	Waiting for forms.	Other delays.				Total delays.		
March.....	1.00	2.00	Cu. yds. 3,122	67.84	8.00	Hours. 10.25	Hours. 18.83	Hours. 2.50	Hours. 43.50	Hours. 42.66	Hours. 94.16	162.00	Cu. yds. 31.28	41.88		
April.....	1.82	3.65	16,736	499.42	58.75	5.99	2.50	2.50	52.84	127.91	288.58	733.00	35.65	63.61		
May.....	2.00	3.84	24,460	564.73	54.66	5.99	2.50	2.50	52.84	227.12	290.27	855.00	43.35	66.05		
June.....	2.00	3.84	24,456	550.80	70.41	11.68	29.68	2.50	67.28	170.15	346.20	900.00	44.36	61.20		
Total.....	1.80	3.89	67,774	1,632.79	191.82	27.92	48.51	2.50	163.62	567.84	1,002.21	2,655.00	41.69	62.25		
Per cent of total.....				62.25	7.23	1.05	1.83	.09	6.16	21.39	37.75	100.00				

<sup>1</sup> Bucket measurement.

NOTE.—One crane began operations on Mar. 22 and one crane on Apr. 7.

## EXHIBIT C.—PERFORMANCE OF ROCK CRUSHING PLANTS AND OF CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1911—Contd.

TABLE 11.—Performance of chamber cranes, *Pedro Miguel Lock, fiscal year 1910-11.*

[Plant consists of four electrically operated cranes.]

## PACIFIC DIVISION.

Months.	Average number of cranes.	Material placed.			Service time.						Rate per hour per crane.		Per cent of working time to total time under pay.	
		Concrete. <sup>1</sup>	Stone.	Total.	Delay.					Total hours per month.	Working time.	Total time.		
					Hours working.	Repairs to cranes.	Waiting for concrete.	Waiting for forms.	Other delays.					Total delays.
July.....	3.56	Cu. yds. 32,121	Cu. yds. 206	Cu. yds. 32,326	689.30	31.32	Hours. 41.53	Hours. 16.59	Hours. 17.28	Hours. 103.72	746.02	Cu. yds. 50.56	Cu. yds. 43.33	85.57
August.....	4.00	46,224	334	46,558	786.51	55.97	43.27	19.25	24.96	61.74	929.98	61.74	52.21	84.60
September.....	3.96	49,022	466	49,488	636.41	23.69	78.67	60.76	39.82	73.05	862.35	73.05	57.39	76.64
October.....	3.93	64,126	137	64,263	710.46	23.92	138.83	38.85	40.99	76.38	958.04	76.38	65.64	74.16
November.....	4.00	46,438	15	46,453	647.97	24.67	70.87	85.99	19.67	89.17	849.17	74.78	57.06	76.84
December.....	3.66	30,816	211	31,047	466.09	18.04	25.67	269.76	46.47	309.94	826.03	94.61	37.55	86.46
January.....	3.68	32,876	32	33,902	534.80	14.15	49.77	168.00	43.23	273.23	800.03	64.59	43.35	66.63
February.....	4.00	26,430	6	26,436	433.19	18.31	67.43	185.90	63.27	394.61	818.00	83.83	34.75	86.66
March.....	3.40	36,117	1	36,118	588.95	9.63	129.41	157.34	84.02	347.69	738.00	84.98	30.63	89.07
April.....	1.79	22,894	8	22,902	390.31	23.76	73.23	166.68	60.22	287.00	728.00	57.91	30.63	52.88
May.....	1.38	11,368	11	11,368	199.70	4.76	69.37	52.95	55.66	67.03	387.00	57.03	29.43	41.73
June.....	3.45	401,725	1,430	403,155	6,280.02	232.20	863.46	1,275.17	617.27	64.71	3,106.10	56.88	23.74	67.44
Total.....					6,280.02	232.20	863.46	1,275.17	617.27		9,238.12		43.64	
Per cent of total.....					67.44	2.73	9.35	13.80	6.68		100.00			

<sup>1</sup> Bucket measurement.

NOTE.—Four cranes were in operation to Apr. 20; three to May 9, and two the remainder of the year.

EXHIBIT D.—COMPARATIVE STATEMENT OF ADMINISTRATIVE AND GENERAL EXPENSES  
FOR FISCAL YEAR 1910-11.

No.	Items.	Fiscal year—		Increase.	Decrease.
		1911	1910		
1	General administrative expenses.....	\$294,085.16	\$283,029.13	\$11,056.03	.....
	Miscellaneous general expenses:				
2	On Isthmus.....	85,801.81	91,993.85	.....	\$6,192.04
3	Canal Record.....	18,618.48	19,444.78	.....	826.30
4	Clubhouses.....	51,193.99	42,324.47	8,869.43	.....
5	Isthmian Canal Commission band.....	12,221.49	12,389.97	.....	168.57
6	In the United States.....	88,408.55	114,548.73	.....	26,140.18
	Disbursing officers:				
7	On Isthmus.....	74,546.96	76,561.86	.....	2,014.91
8	In the United States.....	33,492.63	33,453.01	39.62	.....
	Examiners of accounts:				
9	On Isthmus.....	172,917.14	178,080.45	.....	5,113.31
10	In the United States.....	11,759.45	11,502.39	257.06	.....
11	Transportation on Isthmus (passenger).....	123,238.38	132,000.00	.....	8,761.62
12	Telegraph and telephones.....	151,072.27	129,655.88	21,416.39	.....
13	Purchasing expenses in United States.....	197,848.19	173,303.13	24,545.06	.....
14	Hotel equipment.....	21,330.53	20,854.23	476.30	.....
15	Hotel incidental expenses.....	22,559.18	27,590.26	.....	5,031.08
16	Operation of stores.....	496,312.83	417,372.14	78,940.69	.....
17	Freight, etc.....	.....	96,867.63	.....	96,867.62
18	Recruiting.....	71,368.88	139,896.81	.....	68,527.93
19	Quarters.....	480,495.95	543,097.07	.....	62,601.12
	Corrals:				
20	Equipment.....	.....	41,931.77	.....	41,931.77
21	Operations.....	.....	69,650.70	.....	69,650.70
22	Construction of buildings, department construction and engineering.....	7,420.94	.....	7,420.94	.....
23	Alteration of buildings, department construction and engineering.....	7,808.59	.....	7,808.59	.....
24	Clubhouse equipment.....	9,294.56	.....	9,294.56	.....
25	Operation dock and wharves, Isthmian Canal Commission.....	82,730.51	.....	82,730.51	.....
26	Operation dock and wharves, Panama R. R.....	22,884.61	.....	22,884.61	.....
	Total.....	2,537,405.89	2,655,498.25	.....	118,092.36

NOTES.—Items 17, 25, 26: During the year 1910 expenses of handling cargo over docks by Panama R. R. and of operating commission docks were charged to item 17. During the year 1911 these expenses were segregated and charged to items 25 and 26.

Items 20, 21: During the year 1910 the balance of the expenses under these heads, after charging the departments and divisions with the value of the service rendered them, was shown under items 20 and 21. During the year 1911 such balances were absorbed under item 16 (operation of stores) and 19 (quarters).

Items 22, 23: During the year 1910 these expenses were charged to "General Items" under account 408 (construction of buildings) and 409 (repair of buildings), and not prorated to construction costs.

Item 24: This item represents the expense of furnishing the clubhouses at Gatun and Corozal.

**EXHIBIT E.—STATEMENT OF SALARY DISBURSEMENTS BY DEPARTMENTS AND DIVISIONS, AND BY APPROPRIATIONS, FOR THE FISCAL YEAR ENDED JUNE 30, 1911.**

Department or division.	Officers and employees.		Skilled and unskilled labor.		Total pay rolls.
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.
Chairman and chief engineer .....	\$364,941.27	87.04	\$54,193.51	12.96	\$419,134.78
Atlantic division .....	1,058,312.81	20.67	4,062,834.11	79.33	5,121,146.92
Central division .....	810,185.00	15.11	4,552,745.36	84.89	5,362,930.36
Pacific division .....	546,724.90	18.67	2,382,174.03	81.33	2,928,898.93
Mechanical division .....	201,556.55	10.25	1,764,618.66	89.75	1,966,175.21
Quartermaster's department .....	462,398.87	33.33	924,805.78	66.67	1,387,204.65
Subsistence department .....	85,764.78	40.80	124,437.81	59.20	210,202.59
Examiner of accounts .....	182,583.43	100.00	.....	.....	182,583.43
Disbursing officer .....	65,720.10	100.00	.....	.....	65,720.10
Personal injury claims .....	20,637.35	11.65	156,456.57	88.35	177,093.92
Total, construction and engineering .....	3,798,835.06	21.32	14,022,315.83	78.68	17,821,150.89
Sanitary department .....	689,986.72	75.62	222,477.17	24.38	912,463.89
Personal injury claims .....	20.30	100.00	.....	.....	20.30
Total, sanitary department .....	690,007.02	77.26	222,477.17	22.74	912,484.19
Department of civil administration .....	592,481.92	97.16	17,311.58	2.84	609,793.50
Personal injury claims .....	1,730.92	100.00	.....	.....	1,730.92
Total, department of civil administration .....	594,212.84	97.17	17,311.58	2.83	611,524.42
Total, all departments .....	5,083,054.92	26.28	14,262,104.58	73.72	19,345,159.50

**EXHIBIT F.—CONSTRUCTION OF PANAMA R. R. CO. DOCK AT BALBOA, FISCAL YEAR  
ENDED JUNE 30, 1911.**

	Quantity of work done.	Amount.	Unit cost.
<b>Preliminary and general work:</b>	<b>Cubic yards.</b>		
Boring and test pits.....		\$2,807.61	
Clearing site.....		760.20	
Pumping and drainage.....		1,390.36	
Maintenance of equipment.....		3,651.76	
Operation steam boilers.....		1,238.66	
Division expense.....		848.90	
<b>Total.....</b>		<b>10,497.49</b>	
<b>Dredging:</b>			
Clearing for dredges.....	705,465	624.59	\$0.0009
Seagoing suction dredge—			
Operation.....	58,420	3,573.56	.0612
Repairs.....	58,420	1,397.07	.0239
Ladder dredge—			
Operation.....	647,045	14,275.00	.0221
Repair.....	647,045	8,606.70	.0133
Tugs, clapsnets, and scows—			
Operation.....	647,045	33,288.87	.0514
Repairs.....	647,045	18,099.61	.0289
Small boats—			
Operation.....	705,465	2,248.78	.0032
Repairs.....	705,465	2,707.77	.0038
Division expenses.....	705,465	4,064.02	.0058
<b>Total.....</b>	<b>705,465</b>	<b>89,484.97</b>	<b>.1268</b>
<b>Excavation for piers:</b>			
Excavation by hand.....	1,223	6,587.72	5.3865
Excavation by orange peel.....	2,846	1,974.30	.6935
Disposal of waste.....	4,069	2,280.42	.5555
Pumping.....	4,069	2,053.83	.5048
Division expense.....	4,069	804.26	.1977
<b>Total.....</b>	<b>4,069</b>	<b>13,680.53</b>	<b>3.3621</b>
<b>Concrete substructure:</b>			
Forms.....	558	2,595.23	4.6509
Cement.....	558	2,622.51	4.6998
Stone.....	558	1,608.41	2.8825
Sand.....	558	350.06	.6273
Large rock.....	558	85.67	.1535
Mixing.....	558	2,043.94	3.6631
Placing.....	558	1,541.37	2.7623
Reinforcements.....	558	22,998.14	41.2153
Division expense.....	558	864.79	1.5498
<b>Total.....</b>	<b>558</b>	<b>34,710.12</b>	<b>62.2045</b>
<b>Concrete superstructure:</b>			
Reinforcements.....		107.15	
Division expense.....		8.58	
<b>Total.....</b>		<b>115.73</b>	
<b>Total cost.....</b>		<b>148,488.84</b>	

NOTE.—The charge for "Reinforcements" under "Concrete substructure" includes \$19,893.42 for reinforcing material, the quantity being sufficient to place 10,000 cubic yards of concrete, the total estimate of quantity to be placed, or an average of \$1.9893 per cubic yard. Using this figure in the unit cost column, gives a total cost to date of \$22,978.5 per cubic yard.

Plant charges for account of this work have not been taken up, as the quantities have not yet been determined. To July 30 there had been expended \$34,046.49 for plant and equipment.





## APPENDIX J.

### REPORT OF LIEUT. COL. C. A. DEVOL, QUARTERMASTER'S DEPARTMENT, UNITED STATES ARMY, CHIEF QUARTERMASTER, IN CHARGE OF QUARTERMASTER'S DEPARTMENT.

ISTHMIAN CANAL COMMISSION,  
QUARTERMASTER'S DEPARTMENT,  
*Culebra, Canal Zone, July 1, 1911.*

SIR: I have the honor to submit the following report of the operation of the quartermaster's department for the fiscal year ending June 30, 1911:

Changes in the organization of the department during the year were as follows:

1. Transfer of Gatun lumber yard from the Atlantic division to this department, effective July 15, 1910.

2. Construction of a storehouse for obsolete material, in accordance with circular No. 323, revised August 24, 1910.

3. Transfer of the storehouse of the mechanical division at Pedro Miguel to this department, effective October 11, 1910.

4. Transfer of construction and repair of sidewalks from the construction division to this department, effective December 1, 1910.

5. Transfer of the Panama Railroad storehouse at Cristobal to this department, effective January 1, 1911.

6. Closing of the Lirio mill, effective April 1, 1911.

7. Transfer of scrap operations and scrap gang from the Panama Railroad to this department, effective April 10, 1911.

8. Transfer of storehouses of the Atlantic division, containing dredge repair parts, at Gatun and Cristobal, to this department, effective April 15, 1911.

Arrangements have been made to take over the Lirio material yard of the central division, and the Toro Point material yard of the Atlantic division, on July 1, 1911.

#### PERSONNEL.

The officers of this department are as follows: Lieut. Col. C. A. Devol, chief quartermaster; Capt. R. E. Wood, assistant chief quartermaster; Capt. C. Nixon, depot quartermaster; Lieut. Walter D. Smith, constructing quartermaster; Mr. C. H. Mann, chief clerk.

Following changes in personnel were made: Mr. R. K. Morris appointed storekeeper at Gorgona, vice Mr. C. L. Prentiss, resigned, effective November 1, 1910. Mr. X. D. Holt appointed storekeeper at Balboa, vice Mr. R. K. Morris, transferred, effective November 1, 1910. Mr. D. H. Beaman appointed storekeeper at Empire, vice Mr. F. W. Miracle, resigned, effective June 1, 1911.

In spite of the numerous additions to the work of the department, there has been a steady decrease in the number of men employed and in the amount of the pay roll. A comparison of the force at work and the pay rolls at the close of the fiscal year 1910-11 shows as follows:

June 30, 1910 (3,326 men).....	\$131, 122. 39
June 30, 1911 (2,712 men).....	122, 117. 00
Total expenditures fiscal year 1909-10.....	2, 197, 269. 85
Total expenditures fiscal year 1910-11.....	1, 846, 046. 19
Saving.....	351, 223. 66

#### LABOR.

The past year has been the first since the inception of the work that no contract laborers have been brought to the Isthmus by the commission. The last shipment of men received was in January, 1910, over a year and a half ago.

There has been a decided falling off in the immigration to the Isthmus this year. The excess of arrivals over departures in the past two years has been—

1910.....	21, 114
1911.....	4, 910

An analysis of the figures for 1911 shows that the labor supply has been depleted rather than augmented, as the entire excess of arrivals over departures is made up from the coast towns or from the interior of the Republic. These native Panamans rarely work for the commission, and their increased numbers mean no addition to the labor supply of the commission.

The departures of steerage passengers to foreign ports have exceeded the arrivals by more than 1,600. In the last six months the district quartermaster at Cristobal has granted passports to over 600 European laborers who were returning home; and it is probable that out of the 1,600 excess, at least a thousand were Europeans. Quite a number of the West Indian laborers have gone to the brush and can no longer be relied on for steady work.

#### QUARTERS.

During the year there was a temporary shortage of quarters for bachelor American employees at Gorgona and of quarters for laborers at Porto Bello. As the force was reduced at both points, the situation was quickly relieved.

The number of families in quarters is as follows:

Assigned from—	June—	
	1910	1911
List No. 1.....	1, 030	937
List No. 2.....	656	858
Total.....	1, 686	1, 795

Though the total number of families has increased by over a hundred, the families of those men employed prior to January 1, 1908, have diminished, which is an index of the gradual dropping out of the older men.

There are but 10 waiting applicants on the No. 1 list. There are 633 applicants on the No. 2 list—150 of these, however, are quartered in nonhousekeeping or regular quarters at stations other than those at which applications are filed.

No new family quarters were erected during the year except at Toro Point. As bachelor quarters have been abandoned, the buildings have been utilized for nonhousekeeping quarters. There are now 122 families in this class of quarters. The work in the Chagres section of the central division was completed in the spring, and all laborers and gold employees of that division, in the Tabernilla-San Pablo district, were transferred to other districts. The houses formerly used as gold quarters are being utilized as family quarters for employees in other districts who are unable to secure quarters at the points where they work.

Although we are quartering several hundred laborers of the Panama Railroad, who are working on the relocation, the total number of West Indians in laborers' barracks is 200 less than the preceding year, and the number of Europeans is 1,000 less. Laborers' barracks in the territory extending from Bohio to Mamei, inclusive, have been abandoned and advertised for sale. Camps at Santa Cruz, Cucaracha, and Cartegena have been abandoned. The buildings at Santa Cruz have been demolished and sold.

#### ZONE SANITATION.

The grass-cutting area has been further extended and more territory is being covered than ever before.

The removal of garbage has increased slightly. A new incinerator was installed at Gatun in November, 1910, and a road built to it from New Gatun. This has saved time and labor in the garbage-removal work at that point.

The cost of work performed for the sanitary department has been as follows:

	1910	1911
Zone sanitation.....	\$233,693.00	\$210,408.29
Charges to hospitals, quarantine, etc.....	97,139.81	77,284.48
Total.....	330,832.81	287,692.77

#### CORRALS.

Besides the regular delivery work and the work performed for the sanitary department, teams have been used in the construction of Sweetwater reservoir at Toro Point, Gatun reservoir, road work between Pedro Miguel and Corozal, street work at Panama and Colon, and on the Bas Obispo diversion. A number of teams and brakes were used by the department of civil administration during the school year.

The teams removed approximately 20,000 yards of rock and dirt from the Bas Obispo diversion at a very reasonable cost. During the dry season on small isolated jobs of this character scraper work has been found to be economical.

The work at Sweetwater reservoir and, to a lesser extent, at the Bas Obispo diversion was very hard on the stock, six animals being lost at Sweetwater. The loss of mules was not as heavy as during the preceding year, as there were no infectious diseases. Fifty-four animals died or were condemned and sold or destroyed.

No mules have been purchased during the past two years and no saddle horses during the past two and one-half years. The majority of stock has been in service on the Isthmus between four and five years, and it is beginning to show the effects of its hard service.

Repairs to harness and wagons have been concentrated at the large corrals and in that way economies effected. A comparison of costs for the past four years is as follows:

Dates.	Animals.	Cost.
June, 1906.....	637	\$24,480.84
June, 1909.....	756	25,601.19
June, 1910.....	749	22,963.39
June, 1911.....	721	18,946.98

#### BUILDING CONSTRUCTION.

Mr. C. B. Cook was appointed inspector of construction and repairs, vice Mr. William H. McFarland, resigned, August 8, 1910. Two additional traveling gangs were formed, one of carpenters and one of painters. Reductions in the force of artisans of all district quarter-masters were made.

Nine buildings and one addition were put up under contract at a total cost of \$44,429.30. Nearly all of these buildings were at Toro Point. There was a reduction in the unit cost of the types 18 and 27.

The following new construction was handled by the traveling gangs:

	Number.	Cost.
Buildings.....	71	\$88,531.45
Additions to buildings.....	16	29,035.81
Buildings moved and reconstructed.....	32	34,397.11
Native huts at Nombre de Dios.....	85	6,656.45
Total.....		158,620.82

In addition to the above, 29 buildings were taken down in sections and the material used in the construction of buildings at other points.

This work covered buildings of every character, for all departments, and embraced everything from bathhouses and range closets to a new storehouse at Toro Point. In the greater part of the buildings constructed by the traveling gangs old lumber or material recovered from demolished buildings was used.

The total number of buildings on June 30, 1911, was 2,985, as compared with 3,078 on June 30, 1910. There was an increase in the number of American buildings and a decrease of 112 in the number of French buildings. During the year 86 buildings were demolished and 109 sold. Most of the buildings in the Tabernilla-San Pablo-Bohio district have been advertised for sale and a number of them sold.

There has been a steady reduction in the cost of repair work. The total cost for the year was \$195,295.06, or less than 2 per cent on the estimated total value of the buildings.

#### MATERIAL AND SUPPLIES.

Results obtained in this branch of the work during the past fiscal year have been more satisfactory than since the inception of the work.

The efficient operation of the supply branch of this service demands the complete control of stock, viz, of all material unapplied to the work. This control enables the entire amount of material on hand to be applied to the entire work. Separate control by divisions and departments does not permit such application, increases the amount of material necessary to be carried, and would materially increase the amount of unapplied stock at the end of the work.

The chairman's circulars, Nos. 296 and 296-A, of December, 1909, directed the transfer of all storehouses in the Atlantic and Pacific divisions to the quartermaster's department. This system of concentration has been further carried out during the past year by the following transfers to the quartermaster's department:

*Atlantic division.*—Material yard, Toro Point; storehouse for dredge repair parts, Cristobal; storehouse for dredge repair parts, Gatun; lumber yard, Gatun.

*Central division.*—Five field storehouses (steam-shovel material); Empire shops (steam-shovel material); Lirio material yard.

*Mechanical division.*—Storehouse at car shops, Pedro Miguel.

*Panama Railroad.*—Main storehouse, Cristobal; substorehouse, Panama.

This completed the system and permitted the following action:

All storekeepers prepared surplus lists. Surplus stock was concentrated at Mount Hope, Empire, and Gorgona, where it could be intelligently handled and substitutions made. This movement of stock was of large proportions, \$1,200,000 of material being turned in to Mount Hope, Empire, and Gorgona.

Certain classes of material were localized: Steam shovel, drill-repair parts, and electric material at Empire; air-brake material, lubricators, injectors, car, locomotive, and other similar repair parts at Gorgona; general stock at Mount Hope. The construction divisions and the shops collected unused material on their work and shipped to quartermaster storehouses.

Circular No. 355-A was issued by the chairman January 7, 1911, inviting attention to amount of material on hand, and authorizing substitutions wherever possible, in order to reduce the stock as far as practicable at this time.

The general purchasing officer at Washington was also informed that a policy of stock reduction had been inaugurated, and that in future it might be necessary to resort more frequently to emergency purchases.

The results of this work have begun to show:

Stock on hand in quartermaster storehouses June 30, 1910.....	\$4, 691, 034. 10	
Stock on hand in quartermaster storehouses June 30, 1911.....	4, 503, 643. 60	
Decrease.....		187, 390. 50
Material transferred to the quartermaster's department from outside departments:		
Miscellaneous material to Mount Hope.....	\$87, 494. 20	
Panama Railroad storehouse.....	403, 336. 65	
Atlantic division to Mount Hope.....	60, 557. 49	
Atlantic division to Gatun.....	81, 706. 42	
Outside divisions to Gorgona.....	40, 118. 82	
Outside divisions to Empire.....	301, 344. 52	
Mechanical division to Pedro Miguel.....	20, 102. 12	
		994, 660. 22
Total.....		1, 182, 050. 72

The above total, therefore, represents the total reduction in the stock of material on hand.

A comprehensive record of all material on hand permits of better supervision of requisitions, both "C" requisitions pertaining to the quartermaster's department, and "A" requisitions pertaining to other divisions and departments. A large number of cancellations and substitutions have been made; and the value of stock material received from the United States in the last six months is \$800,000 less than for the same period last year, although this year's purchases include material for the Panama Railroad.

A storehouse for obsolete and unserviceable material has been established at Mount Hope for the purpose of collecting all such stock, both equipment and supplies, in one place, and offering for sale to the public when material of enough value has been accumulated to warrant such action. Up to date the value of such stock is \$186,396.14. The work, however, is in its inception, and can hardly be considered as much more than started.

#### SCRAP.

The work of recovering French scrap—iron and steel—and shipping to the United States has continued throughout the year. Also the shipment of American scrap—iron and steel—from the various shops. Various scrap of other kinds is carefully collected by district quartermasters and storekeepers and disposed of in the United States. The large accumulation of scrap at Gorgona has been disposed of, nearly 8,000 tons having been shipped from this one point. Shop scrap is shipped direct and rehandling saved.

Four thousand eight hundred and forty-one tons of rail was recovered for issue to the work. Of this, 2,659 tons was French and 2,182 tons old American rail.

A summary of all scrap operations from the inception of the work to date is as follows:

Items.	Quantity.	Average selling price.	Gross amount realized.	Net amount realized.
Iron and steel.....	28,933,463 long tons.	\$11.86.....	\$343,184.51	\$179,902.48
Screening.....	231,598 pounds.....	\$7.75 per cwt.....	17,960.09	14,645.36
Rope.....	56,689 pounds.....	\$2.15 per cwt.....	1,204.61	1,137.25
Belting.....	1,216 pounds.....	\$0.54 per cwt.....	6.51	3.44
Rubber.....	83,188 pounds.....	\$2.01 per cwt.....	1,720.18	1,510.89
Hose.....	113,904 pounds.....	\$2.50 per cwt.....	2,852.38	2,332.34
Total.....			366,988.28	189,531.76

Respectfully submitted.

C. A. DEVOL,  
*Chief Quartermaster.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

- EXHIBIT**
- 1.—Force actually at work on June 30, 1911.
  - 2.—Statement showing force at work for the Isthmian Canal Commission and Panama Railroad Co. from December, 1906, to June, 1911.
  - 3.—Occupants of commission quarters, June 30, 1911.
  - 4.—Applications for married quarters on file June 30, 1911.
  - 5.—Animals in corrals, June 30, 1911.
  - 6.—Number of buildings on the Canal Zone, June 30, 1911.
  - 7.—Summary of buildings constructed.
  - 8.—Demolition and sales of buildings.
  - 9.—Value of material received during 1910–11, on requisitions of the various departments.
  - 10.—Freight statement.
  - 11.—Value of stock on hand June 30, 1911.
  - 12.—Important items due on United States requisitions June 30, 1911.
  - 13.—Important items of material purchased from inception of canal work, 1904 to June 30, 1911.
  - 14.—Important items of material received from July 1, 1910, to June 30, 1911.
  - 15.—Scrap shipments.
  - 16.—Sale of scrap iron.
  - 17.—Sale of miscellaneous scrap.



EXHIBIT 1.—*Force actually at work on June 28, 1911.*

Department or division.	Silver employees.															Total gold.	Total silver.	Grand total.
	Artisans.						Laborers.											
	Monthly.						Europeans.			20 cents.	16 cents.	13 cents.	10 cents.	7 cents.				
		44 cents.	32 cents.	25 cents.	20 cents.	16 cents.	20 cents.	16 cents.										
Department of construction and engineering.....	4,143	14	18	218	602	2,206	2,680	832		110	461	3,703	2,176	232		17,395	3,195	20,590
Department of civil administration.....	194			2	4	18							10			228	362	590
Department of sanitation.....	680			2	3	5						1	5	9		1,040	373	1,413
Quartermaster's department.....	943		1	115	151	93	273	44		16	3	44	821	6		2,510	202	2,712
Subsistence department.....	608			1	1											610	51	661
Disbursing office.....	7															7	24	31
Examiners of accounts.....	5															5	85	90
Commissary (not included in total).....	555			4	11	26						25	148	70		839	230	1,069
Panama R. R. Co. (not included in total).....																3,065	439	3,534
Relocation (not included in total).....																1,583	117	2,000
Total.....	6,589	14	19	338	761	2,322	2,958	876		126	455	3,752	3,328	247		21,795	4,292	26,087
Week previous, June 21, 1911.....	6,704	14	17	348	851	2,553	3,104	937		125	478	3,974	3,904	279		23,308	4,305	27,613
Changes.....	-115		+2	-10	-90	-231	-146	-81		+1	-13	-222	-576	-32		-1,513	-13	-1,526
Month previous, May 31, 1911.....	6,810	14	18	345	801	2,542	2,933	1,026		128	510	3,816	3,651	273		22,867	4,362	27,229
Changes.....	-221		+1	-7	-40	-220	+25	-150		-2	-45	-64	-323	-25		-1,072	-70	-1,142

NOTE.—All wages specified are in gold.

EXHIBIT 2.—Statement showing force at work for the Isthmian Canal Commission and Panama R. R. Co. from December, 1906, to June, 1911.

Year and month.	Commission.			Total Panama R. R.	Total Panama R. R. and commis- sion.	Laborers.			
	Gold.	Silver.	Total.			Europeans.		13 cents.	10 cents.
						20 cents.	16 cents.		
1906.									
December .....	3,881	15,604	19,485	4,416	23,901	1,591	706	211	6,430
1907.									
January .....	4,033	16,987	21,020	4,796	25,816	1,985	447	213	7,017
February .....	4,357	18,680	23,037	4,575	27,612	2,380	442	251	7,227
March .....	4,411	19,708	24,119	5,249	29,368	2,993	332	282	7,285
April .....	4,570	19,697	24,267	5,475	29,742	3,106	467	374	6,715
May .....	4,465	20,105	24,570	4,892	29,462	3,908	411	192	6,281
June .....	4,404	18,923	23,327	6,119	29,446	3,929	388	205	5,216
July .....	4,529	19,632	24,161	6,192	30,353	3,980	419	281	4,824
August .....	4,546	19,487	24,033	5,834	29,867	4,056	428	309	4,347
September .....	4,638	19,909	23,607	6,238	29,845	4,374	218	515	3,749
October .....	4,992	20,836	25,828	6,139	31,967	4,839	295	770	4,031
November .....	4,822	20,507	25,329	6,148	31,477	4,764	292	806	3,663
December .....	4,668	19,065	23,763	4,940	28,703	4,518	275	852	3,689
1908.									
January .....	4,935	20,493	25,428	6,557	31,985	4,978	276	905	3,748
February .....	5,083	20,745	25,828	6,430	32,258	5,016	472	728	3,643
March .....	4,996	20,556	25,552	7,103	32,655	4,897	510	692	3,677
April .....	4,950	21,168	26,118	7,052	33,170	4,773	593	729	3,738
May .....	4,745	21,036	25,881	7,052	32,933	4,400	562	684	4,139
June .....	4,587	20,991	25,578	5,022	31,200	4,413	500	537	4,616
July .....	4,477	21,049	25,526	5,794	31,320	4,187	558	510	4,344
August .....	4,396	21,486	25,882	5,794	31,676	4,505	411	1,374	4,566
September .....	4,328	21,129	25,457	5,132	30,589	4,865	377	1,263	4,103
October .....	4,183	20,752	24,935	5,766	30,701	4,793	327	1,343	4,004
November .....	4,161	19,803	23,964	5,863	29,827	4,422	368	1,593	3,854
December .....	4,275	20,142	24,417	6,091	30,508	4,617	188	2,010	3,682
1909.									
January .....	4,295	20,583	24,878	6,393	31,271	4,693	220	2,335	3,560
February .....	4,334	20,858	25,192	6,623	31,815	4,720	265	1,969	3,315
March .....	4,381	21,352	25,733	7,263	32,996	4,690	478	1,923	3,124
April .....	4,355	22,480	26,835	6,804	33,699	4,100	510	5,740	3,229
May .....	4,262	22,020	26,282	6,365	32,659	3,817	359	2,664	5,646
June .....	4,166	22,302	26,468	6,472	32,940	3,672	475	1,797	5,370
July .....	4,198	22,740	26,938	6,963	33,901	3,591	485	2,005	5,558
August .....	4,070	22,449	26,519	7,223	33,742	3,446	530	2,681	5,793
September .....	4,191	23,158	27,349	7,861	35,210	3,442	544	2,577	6,009
October .....	4,376	23,411	27,787	7,618	35,405	3,366	661	2,906	5,754
November .....	4,372	22,014	26,386	7,422	33,808	3,100	704	2,786	5,167
December .....	4,339	22,905	27,244	6,701	33,945	3,398	1,113	4,036	5,113
1910.									
January .....	4,532	25,218	29,750	7,636	37,386	3,641	1,221	4,289	5,578
February .....	4,602	25,212	29,814	7,644	37,458	3,451	1,135	4,452	5,420
March .....	4,553	26,284	30,837	7,839	38,676	3,710	1,553	4,587	5,195
April .....	4,485	24,726	29,211	7,692	36,903	3,652	1,596	4,054	4,874
May .....	4,368	25,192	29,560	7,236	36,796	3,669	1,936	3,678	5,287
June .....	4,367	24,717	29,084	6,494	35,578	3,354	1,986	3,675	5,187
July .....	4,389	25,372	29,901	6,549	36,450	3,506	2,056	3,793	5,714
August .....	4,445	25,505	29,950	5,917	35,867	3,535	1,960	3,850	5,694
September .....	4,439	25,229	29,668	5,681	35,369	3,411	1,679	4,042	5,485
October .....	4,586	25,067	29,693	5,641	35,334	3,409	1,611	3,273	5,067
November .....	4,646	25,044	29,690	5,960	35,650	3,296	1,525	3,358	6,126
December .....	4,705	24,383	29,088	6,044	35,142	3,311	1,440	3,229	4,972
1911.									
January .....	4,375	24,967	29,842	7,429	37,271	3,443	1,300	3,576	4,847
February .....	4,821	23,729	28,550	6,916	35,466	3,190	1,166	3,499	4,123
March .....	4,718	24,132	28,850	6,950	35,806	3,344	1,282	3,583	4,343
April .....	4,540	23,592	28,132	7,127	35,259	3,125	1,172	3,883	4,088
May .....	4,345	23,347	27,692	7,104	34,796	2,992	1,031	3,981	4,135
June .....	4,292	21,795	26,087	6,603	32,690	2,958	876	3,752	3,575

NOTE.—Panama R. R. includes Panama R. R., commissary, and relocation.

EXHIBIT 3.—*Occupants of commission quarters, June 30, 1911.*

Places.	Gold.			Europeans.			West Indians.		
	Men.	Women.	Children.	Men.	Women.	Children.	Men.	Women.	Children.
Balboa.....	282	90	90	1 334	23	31	200	18	34
Ancon <sup>1</sup> .....	253	258	117	9			350	53	24
Corozal.....	242	62	77	146	1	2	78	4	3
Miraflores.....	21	2		459	3	7	165	5	3
Pedro Miguel.....	268	76	106	298	4	8	212	37	51
Paraiso.....	167	84	70	202	6	11	188	118	147
Culebra.....	363	205	218	512	43	67	407	162	209
Empire.....	583	319	303	250	51	76	477	130	187
Las Cascadas.....	231	116	135	249	46	54	237	148	145
Bas Obispo.....	102	57	72	451	23	21	350	30	36
Gorgona <sup>2</sup> .....	779	231	243	145	12	19	275	109	147
Tabernilla <sup>3</sup> .....	93	86	98	23			79	25	34
Gatun.....	829	174	174	1,409	26	41	1,118	24	26
Cristobal <sup>4</sup> .....	898	271	225	300			1,155	217	331
Toro Point.....	68	14	11	84			340		
Porto Bello.....	85	25	24	127	1		206	2	4
Total.....	5,364	2,070	1,972	4,997	239	337	5,906	1,082	1,381

<sup>1</sup> Includes 40 Asiatics.<sup>2</sup> Includes Sabanas police station, Taboga Island, Culebra Island, and Palo Seco.<sup>3</sup> Includes Matachin.<sup>4</sup> Includes San Pablo, Mamel, and Bohio.<sup>5</sup> Includes Colon Hospital and Nombre de Dios.<sup>6</sup> Includes 2 Asiatics.EXHIBIT 4.—*Applications for married quarters on file, June 30, 1911.*

Stations.	No. 1 list.	No. 2 list.
Balboa.....		33 ( 8)
Ancon.....	1 (1)	39 ( 3)
Ancon Hospital.....	2	6 ( 1)
Corozal.....		42 ( 3)
Pedro Miguel.....		54 (11)
Culebra.....		16 ( 1)
Empire.....	1	58 (21)
Las Cascadas.....		17 ( 6)
Bas Obispo.....		19 ( 3)
Gorgona.....		96 (39)
Tabernilla.....		8 ( 1)
Gatun.....	3 (3)	122 (45)
Cristobal.....	3 (1)	104 ( 8)
Toro Point.....		7 ( 2)
Porto Bello.....		12 ( 3)
Total.....	10 (5)	633 (150)

NOTE.—The figures in parenthesis show the number of applicants already occupying regular or non-housekeeping family quarters at stations other than those at which applications are filed.

EXHIBIT 5.—*Animals in corrals, June 30, 1911.*

Stations.	American horses.	Native ponies.	Mules.	Police ponies.	Private animals.	Total.
Ancon.....	35	7	91	15	44	192
Corozal.....	1	1	9	3	4	18
Pedro Miguel.....	2	1	30	3	17	53
Culebra.....	10	2	47		21	80
Empire.....	9	1	45	6	33	94
Las Cascadas.....		3	25	2	6	36
Gorgona.....		3	25	2	6	36
Tabernilla.....			7			7
Gatun.....	4	2	43		8	66
Cristobal.....	8	1	89	2	37	137
Toro Point.....			2			2
Grand total.....	69	21	418	37	176	721

EXHIBIT 6.—Number of buildings on the Canal Zone, June 30, 1911.

Stations.	Isthmian Canal Commission.	French.	Total.
Alhajuela.....	2	2	4
Ancon.....	190	43	233
Balboa.....	101	31	132
Bas Obispo.....	82	145	227
Bohio.....	1	21	22
Colon Hospital.....	32	10	42
Corozal.....	52	27	79
Cristobal.....	145	105	250
Cruces.....	1	.....	1
Culebra.....	199	99	298
Culebra Island.....	9	.....	9
Empire.....	203	113	316
Frijoles.....	1	3	4
Gatun.....	242	.....	242
Gorgona.....	153	114	267
Las Cascadas.....	91	103	194
Miraflores.....	30	30	60
Nombre de Dios.....	11	.....	11
Palo Seco.....	16	.....	16
Panama.....	1	2	3
Paraiso.....	109	78	187
Pedro Miguel.....	101	25	126
Porto Bello.....	57	.....	57
Sabanas.....	2	.....	2
San Pablo.....	24	45	69
Tabernilla.....	57	34	91
Taboga Island.....	5	4	9
Toro Point.....	32	1	33
Vigia.....	1	.....	1
Grand total.....	1,950	1,035	2,985

EXHIBIT 7.—Buildings constructed, fiscal year 1910-11.

	Num-ber.	Cost.
<b>Constructed by contract:</b>		
New buildings.....	9	\$41,876.58
Addition to building.....	1	2,552.75
Total.....	.....	44,429.33
<b>Isthmian Canal Commission construction:</b>		
New buildings.....	34	20,880.00
Addition to building.....	1	1,862.04
Total.....	.....	22,742.04
<b>Isthmian Canal Commission construction for other departments and divisions:</b>		
Canal Zone government—		
New buildings.....	4	4,511.10
Additions to buildings.....	3	12,465.70
Total.....	.....	16,976.80
Civil administration—New buildings.....	8	4,399.59
Sanitary department—		
New buildings.....	6	7,656.64
Additions to buildings.....	3	2,419.01
Total.....	.....	10,075.65
Atlantic division—		
New buildings.....	5	6,205.57
Additions to buildings.....	2	1,898.08
Native village.....	.....	6,656.45
Total.....	.....	14,760.10
Pacific division—New building.....	1	690.47

## EXHIBIT 7.—Buildings constructed, fiscal year 1910-11—Continued.

	Num-ber.	Cost.
Isthmian Canal Commission construction for other departments and divisions—Con.		
Mechanical division—		
New buildings.....	3	1,077.52
Additions to buildings.....	4	4,595.11
Total.....		5,672.63
Third division, chief engineer—New building.....	1	1,233.96
Young Men's Christian Association—Additions to buildings.....	2	3,243.12
Buildings moved.....	32	34,397.11
		158,620.82

## SUMMARY.

New buildings.....	71	\$88,531.45
Additions to buildings.....	16	29,035.81
Buildings moved.....	32	34,397.11
Native village.....		6,556.45
		158,620.82

NOTE.—Practically all buildings of Isthmian Canal Commission construction were built wholly or in part from material recovered from demolished buildings.

## EXHIBIT 8.—Buildings sold and demolished, fiscal year 1910-11.

Stations.	Sales.	Demolitions.	Total.
Balboa.....	1	1	2
Ancon.....		2	2
Corozal.....	1		1
Pedro Miguel.....	3	5	8
Paraiso.....	3	1	10
Culebra.....	4	22	26
Empire.....	4	5	9
Las Cascadas.....	3	7	10
Bas Obispo.....	35	7	42
Gorgona.....		11	11
San Pablo.....	4	4	8
Tabernilla.....	10	6	16
Bohio.....	33	2	35
Gatun.....		1	1
Cristobal.....	2	10	12
Toro Point.....		1	1
Nombre de Dios.....		1	1
Total.....	100	86	196

EXHIBIT 9.— Value of material received during the fiscal year 1910-11 on requisitions of the various departments.

Departments.	1910						1911						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Construction and engineering.													
Atlantic division.	\$190,917.52	\$248,099.00	\$207,754.23	\$377,722.00	\$329,394.66	\$293,069.75	\$273,488.70	\$223,996.45	\$216,705.39	\$185,056.21	\$191,060.59	\$216,218.82	\$2,952,443.32
Central division.	13,694.73	3,128.46	8,273.96	50,501.04	10,646.80	12,217.00	10,980.92	12,627.69	9,324.26	13,027.42	10,137.05	11,402.46	168,961.77
Pacific division.	127,908.01	180,572.24	175,285.81	113,575.83	267,188.09	247,060.15	254,966.17	197,940.23	180,868.02	184,966.52	167,784.94	196,401.06	2,276,857.26
Mechanical division.	15,896.24	61,621.73	108,608.52	37,389.40	38,481.79	32,566.80	74,215.71	10,880.44	36,683.02	54,906.76	9,816.85	7,048.23	499,125.48
Chief engineer.	1,079.63	842.31	1,181.72	702.46	500.89	283.48	1,880.42	498.73	686.66	1,873.69	1,190.15	1,016.74	11,244.88
Total.	350,498.13	494,233.84	501,104.26	579,880.83	646,202.23	585,227.18	615,031.92	444,941.46	424,277.35	439,850.63	379,989.58	434,087.30	5,896,332.71
Quartermaster's.	489,143.77	405,611.76	315,165.65	403,822.37	542,294.47	428,217.75	159,692.46	124,053.96	287,713.61	398,118.75	236,077.05	246,428.40	4,024,339.90
Sanitary.	4,553.74	6,425.07	4,912.36	21,233.18	13,216.07	5,387.23	6,722.23	5,048.04	9,821.18	5,414.88	4,780.59	7,022.40	94,526.97
Examiner of accounts.	730.00	2,320.00		15.00	162.60	1,246.24	766.50	700.65		737.50	2,777.50	7,181.34	9,837.43
Civil administration.	44.40	733.08	3,275.15	3,251.59	136.48	687.43	170.19	602.91	516.74	884.14	515.28	5,882.67	16,830.06
Disbursing officer.				51.00	265.00	4.30							204.00
Department of law.													204.00
Panama R. R. Co.						59.49	151.68	808.10	161.59	1,135.33	30.50	136.00	10,854.88
Grand total.	844,968.04	909,323.75	824,457.42	1,008,263.87	1,202,246.85	1,020,829.72	762,534.96	596,155.12	702,527.97	844,091.23	632,667.84	693,839.46	10,051,926.26
Local purchases—Isthmus.	196,951.08	181,265.07	67,124.02	320,115.61	213,016.04	168,138.81	205,951.35	207,392.57	94,076.31	355,908.96	283,416.17	197,980.45	2,440,226.40

The local purchases are composed of the following items:

Coal purchased from Panama R. R. ....	\$1,547,688.71
Miscellaneous purchases from Panama R. R. and commissary.	106,008.62
Grade oil from Union Oil Co. ....	772,801.32
Miscellaneous from local merchants.	16,800.10
Postage stamps.	182.76
	2,440,226.40

EXHIBIT 10.—*Freight statement, July 1, 1910, to June 30, 1911.*

Steamship lines.	Number of boats.	General cargo.	Cement.	Lumber.	Ties.		Piling.	Total weight.	Total weight.
					Pieces.	Feet.			
		<i>Pounds.</i>	<i>Pounds.</i>	<i>Fl. B. M.</i>			<i>Lin. ft.</i>	<i>Pounds.</i>	<i>Tons.</i>
Panama R.R.	89	26,944,000	1409,963,200	48,524				437,101,296	218,550.65
United Fruit Co.	107	32,041,692		5,964,762	2,398	75,999	73,190	56,204,736	28,102.37
Ham burg-American.	44	3,923,191						3,923,191	1,961.59
Leyland Line	16	411,843						411,843	205.92
Royal Mail	12	602,732						602,732	301.37
Pacific Mail	9	80,704		10,002				120,712	60.33
California-Atlantic.	9	994,760						994,760	497.38
Tramps:									
Pacific.	8	4,960		9,019,867	96,291	3,211,028	148,175	48,928,540	24,464.27
Atlantic.	59	76,158,826	321,045,200	8,428,390	204,057	8,293,113	770,115	464,089,998	232,045.00
Total	353	141,162,708	731,008,400	23,471,535	302,658	11,580,140	991,480	1,012,377,808	506,188.90

<sup>1</sup> Equivalent to 1,024,908 barrels.<sup>2</sup> Equivalent to 1,827,521 barrels.<sup>3</sup> Equivalent to 802,613 barrels.

NOTE.—The total weights given above do not include the weight of piling. There was also received one (1) tugboat and four (4) steel barges; the latter were loaded with coal, weighing 1,397 tons.

EXHIBIT 11.—*Value of stock on hand, June 30, 1911.*

Storehouses.	Value.	Storehouses.	Value.
Mount Hope	\$1,502,828.23	Empire	\$934,037.28
Dry Dock store	250,755.65	Culebra	5,294.54
Panama R. R. store	109,994.71	Pedro Miguel	30,653.03
Porto Bello	100,345.26	Mitraleres	131,520.92
Toro Point	20,663.76	Coroal	1,990.73
Gatun	336,631.71	Ancon	12,751.10
Tabernilla	1,926.78	Balboa	207,892.14
Gorgona	841,072.54		
Las Cascadas	15,265.12	Total	4,508,643.60

EXHIBIT 12.—*Important items due on United States requisitions, June 30, 1911.*

Articles.	Quantity.	Value.
Cement	<sup>1</sup> 1,527,292	\$1,405,108.64
Cranes:		
Locomotive (5)		46,200.00
Cargo handling (8)		91,720.56
Dredge, steel ladder	1	137,920.56
Dynamite	<sup>2</sup> 10,250,000	399,340.00
Other blasting supplies		1,334,500.00
Lumber	<sup>3</sup> 5,552,979	103,200.98
		147,445.04
Material for locks:		
Lock-gate leaves (includes cost of erection)		5,053,114.82
Fixed irons for rising stem gate valves, etc.		142,473.02
Machinery to operate Stoney gate valves		899,211.00
6 emergency dams		2,245,068.36
Locomotive track material		565,365.43
80 lock-gate recess covers		129,360.00
Miter gate moving and miter forcing machinery		744,600.00
Gates, castings, fixed iron, footbridges for spillways, etc.		609,520.00
4 intake bridges and structural material for decking over operating-machinery chambers in the locks		42,000.00
Piling	<sup>4</sup> 5,600	10,428,712.65
Rails, steel	<sup>5</sup> 3,050	108,250.00
Ties, cross and switch	230,220	98,362.50
Other track material		195,515.00
		63,405.73

<sup>1</sup> Barrels.<sup>2</sup> Pounds.<sup>3</sup> Feet, board measure.<sup>4</sup> Pieces.<sup>5</sup> Gross tons.

EXHIBIT 13.—*Important items of material purchased from inception of canal work, 1904, to June 30, 1911.*

Articles.	Quantity.	Value.
Barges.....	44	\$1,092,830.00
Boats, tug.....	9	566,734.00
Brick (building, fire, and paving).....		248,538.65
Cableways.....	7	365,050.90
Cars.....	4,181	4,655,355.79
Cement.....	12,972,708	3,280,874.74
Compressors, air.....	28	125,504.77
Cranes.....	66	467,508.25
Dredges.....	13	1,892,788.00
Drills, rock.....	725	288,376.59
Explosives:		
Dynamite.....	41,147,750	4,820,243.02
Other blasting supplies.....		498,172.40
Forage and corral supplies.....		618,498.28
<b>Furniture:</b>		
Married quarters.....		271,025.74
Bachelor quarters.....		147,143.50
Hospital quarters.....		76,666.65
Laborers' quarters.....		208,809.00
		703,644.89
<b>Live stock:</b>		
Horses.....		39,212.50
Mules.....		99,572.00
Cows.....		8,650.00
		147,434.50
Locomotives.....	189	1,942,502.00
Lumber.....	177,781,215	4,063,263.10
Material for locks.....		1,791,175.11
Piling.....	112,363	1,249,580.58
<b>Plants:</b>		
Material handling (3).....		689,358.60
Rock crusher (4).....		200,164.68
Filtration (3).....		33,260.00
Pumping (2).....		14,950.00
Boiler (2).....		114,961.00
Hydraulic dredging (1).....		192,868.00
		1,245,562.28
Rails, steel.....	59,887	1,887,342.25
Roofing, corrugated-iron.....		464,216.18
Screening, wire.....		388,979.25
Shovels, steam.....	102	1,094,879.96
Spreaders, earth.....	26	139,687.00
Ties, cross and switch.....	1,756,304	1,457,845.98
Unloaders.....	29	158,839.00

<sup>1</sup> Barrels.  
<sup>2</sup> Pounds.  
<sup>3</sup> Feet, board measure.

<sup>4</sup> Pieces.  
<sup>5</sup> Gross tons.



EXHIBIT 14.—*Important items of material received from July 1, 1910, to June 30, 1911.*

Articles.	Quantity.	Value.
Barges, steel hull.....	4	\$208,700.00
Boats, tug.....	1	85,734.00
Cars, dump and flat.....	237	285,306.00
Cement.....	<sup>1</sup> 1,827,521	1,883,554.72
Cranes, derricks, and hoisting engines.....	6	50,668.00
Dynamite.....	<sup>2</sup> 9,501,850	1,255,322.72
Other blasting supplies.....		89,306.81
Forage and corral supplies.....		72,594.73
Lumber.....	<sup>3</sup> 23,471,535	547,802.92
<b>Material for locks and lock work:</b>		
Ironwork for mitering lock gates, cylindrical valves, etc.....		324,092.20
Rising stem gate valves.....		25,677.02
Material for valve frames.....		163,360.20
Lock gate leaves (amount reported shipped from works as of June 1, 1911).....		321,360.00
Fixed irons for rising stem gate valves, etc.....		227,406.72
Electric locomotive return tracks.....		13,850.38
52 anchorages.....		23,023.54
Mosaic tiles.....		1,444.38
Steel girders and reenforcing bars.....		76,869.88
		1,177,063.32
Oils and greases.....		46,757.59
Piling.....	<sup>4</sup> 19,719	274,068.13
Rails, steel.....	<sup>5</sup> 3,463	108,546.26
Other track material.....		156,137.92
Steel, flat, round, square, tool, etc.....		280,841.75
Ties, cross and switch.....	302,656	231,117.41

<sup>1</sup> Barrels.<sup>2</sup> Pounds.<sup>3</sup> Feet, board measure.<sup>4</sup> Pieces.<sup>5</sup> Gross tons.EXHIBIT 15.—*Scrap shipments, 1910-11.*

Steamers.	Date shipped.	American.	French.	Selling price per long ton.	Amount realized.
		<i>Long tons.</i>	<i>Long tons.</i>		
Panama.....	July 6, 1910	206,000		\$11.36	\$1,044.71
Cristobal.....	July 7, 1910	1,373,201	817,000	10.0175	9,794.79
Ancon.....	July 27, 1910	332,550	342,000	11.30	3,402.86
Cristobal.....	Aug. 10, 1910	1,290,200	274,000	10.45	7,297.27
Allianca.....	Aug. 4, 1910	408,400		10.29	1,876.09
Wotan.....	Aug. 15, 1910		1,112,540	10.13	5,040.00
Ancon.....	Aug. 26, 1910	768,200	454,000	10.55	5,756.34
Cristobal.....	Sept. 8, 1910	2,154,300	562,000	10.60	12,866.06
Ancon.....	Sept. 26, 1910		2,543,500	9.81	11,139.17
Cristobal.....	Oct. 10, 1910	946,450	1,120,000	9.36	8,634.81
Do.....	Nov. 12, 1910	639,500	120,000	10.42	3,533.03
Ancon.....	Nov. 27, 1910	946,300	386,000	10.53	6,263.00
Cristobal.....	Dec. 16, 1910	1,122,300	350,000	10.83	7,118.31
Ancon.....	Dec. 28, 1910	75,900	414,000	9.31	2,036.15
Mills.....	Feb. 20, 1911	2,040,870	2,206,840	13.61	26,820.78
Lyra.....	Mar. 7, 1911	1,370,395	1,803,555	12.87	18,236.04
Cristobal.....	Mar. 23, 1911	43,000	398,100	9.52	1,874.68
San Mateo.....	Apr. 7, 1911	1,252,105	138,425	10.11	6,276.01
Ancon.....	Apr. 9, 1911	28,000	382,800	10.17	1,865.11
P. A. Wilhelm.....	May 23, 1911	216,400	44,000	9.58	1,113.68
Lyra.....	May 26, 1911	2,352,680	2,106,160	10.67	21,241.11
P. A. Wilhelm.....	June 20, 1911	324,600		10.20	1,523.62
L. Luckenbach.....	June 21, 1911	1,380,600	859,400	11.77	11,170.00
Total.....		19,281,351	16,436,320		174,923.61

American..... long tons.. 8,007,748  
 French..... do..... 7,337,643

Total..... 15,945,389  
 Average price per long ton..... \$10.97

EXHIBIT 16.—*Sale of scrap iron.*

FISCAL YEAR 1909-10.

Scrap sold in United States:			
Old French (22,547,087 pounds).....	long tons..	10,199.592	
American (6,246,065 pounds).....	do.....	2,788.422	
Total (29,093,152 pounds).....	do.....	12,988.014	
Gross amount realized (\$12.96 per long ton).....			\$168,280.90
Expenses:			
Freight.....	\$66,213.16		
Stevedoring.....	13,939.58		
Miscellaneous.....	4,794.92		
Total (\$6.54 per long ton).....		84,947.66	
Net amount realized (\$6.42 per long ton).....			83,313.24

FISCAL YEAR 1910-11.

Scrap sold in United States:			
Old French (16,436,320 pounds).....	long tons..	7,337.643	
American (19,281,351 pounds).....	do.....	8,607.746	
Total (35,717,671 pounds).....	do.....	15,945.389	
Gross amount realized (\$10.97 per long ton).....			\$174,923.61
Expenses:			
Freight.....	\$62,678.09		
Stevedoring.....	9,243.84		
Miscellaneous.....	2,712.44		
Demurrage.....	3,700.00		
Total (\$4.91 per long ton).....		78,334.37	
Net amount realized (\$6.06 per long ton).....			96,589.24

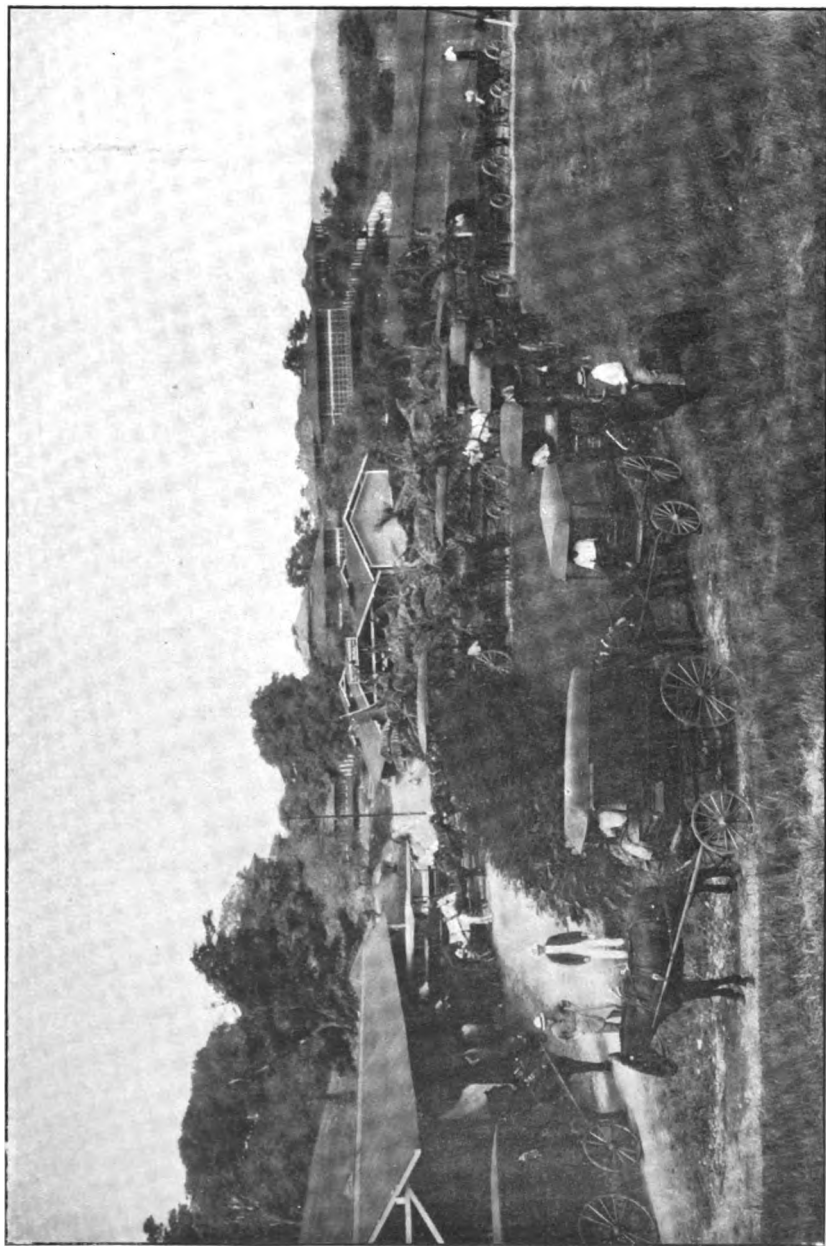
TOTAL.

Scrap sold in United States:			
Old French (39,263,407 pounds).....	long tons..	17,537.235	
American (25,527,416 pounds).....	do.....	11,396.168	
Total (64,810,823 pounds).....	do.....	28,933.403	
Gross amount realized (\$11.86 per long ton).....			\$343,184.51
Expenses:			
Freight.....	\$128,891.25		
Stevedoring.....	23,153.42		
Miscellaneous.....	7,507.36		
Demurrage.....	3,700.00		
Total (\$5.64 per long ton).....		163,282.03	
Net amount realized (\$6.22 per long ton).....			179,902.48

EXHIBIT 17.—*Sale of miscellaneous scrap.*

Items and fiscal years.	Quantity.	Average selling price per hundred-weight.	Gross amount realized.	Expenses.	Net amount realized.	Net selling price per hundred-weight.
<b>SCREENING.</b>						
	<i>Pounds.</i>					
1906-9.....	103,509	\$7.11	\$7,355.00	\$1,981.25	\$5,373.75	\$5.19
1909-10.....	81,172	8.34	6,774.18	1,145.34	5,628.84	6.93
1910-11.....	46,917	8.17	3,830.91	188.14	3,642.77	7.76
Total.....	231,598	7.75	17,960.09	3,314.73	14,645.36	6.32
<b>ROPE.</b>						
1909-10.....	916	2.10	19.24	2.21	17.03	1.86
1910-11.....	57,773	2.16	1,245.37	126.15	1,120.22	1.94
Total.....	58,689	2.15	1,264.61	127.36	1,137.25	1.93
<b>BELTING.</b>						
1910-11.....	1,216	.54	6.51	3.07	3.44	.28
<b>RUBBER.</b>						
1909-10.....	61,179	2.28	1,394.23	158.32	1,235.91	2.02
1910-11.....	22,009	1.48	325.95	50.97	274.98	1.25
Total.....	83,188	2.07	1,720.18	209.29	1,510.89	1.82
<b>HOSE.</b>						
1909-10.....	52,313	3.07	1,607.81	351.84	1,255.97	2.40
1910-11.....	61,591	2.02	1,244.57	168.20	1,076.37	1.75
Total.....	113,904	2.50	2,852.38	520.04	2,332.34	2.06





CORRAL AT ANCON, JUNE, 1911.



## APPENDIX K.

### REPORT OF LIEUT. FRANK O. WHITLOCK, FOURTEENTH CAV- ALRY, UNITED STATES ARMY, ACTING SUBSISTENCE OFFICER, IN CHARGE OF SUBSISTENCE DEPARTMENT.

ISTHMIAN CANAL COMMISSION,  
SUBSISTENCE DEPARTMENT,  
*Cristobal, Canal Zone, July 24, 1911.*

SIR: I have the honor to submit the following annual report of the operations of the subsistence department for the year ending June 30, 1911:

On June 30, 1911, this department was operating the Hotel Tivoli, 19 line hotels, 3 night restaurants, 16 European laborers' messes, and 14 common laborers' kitchens. The total revenue for the year from the line hotels, restaurants, messes, and kitchens was \$1,254,262.40, a decrease of \$96,395.65 as compared with last year. The total supplies consumed decreased \$57,660.17 and total cost of service decreased \$37,980.50, giving total cost of operations of \$1,221,469.29, a decrease of \$95,640.67 as compared with last year. The ratio of cost of service to revenue was 1.6 per cent less than last year, of supplies consumed to revenue 1.5 per cent greater, and of total cost of operations to revenue one-tenth of 1 per cent less. The cost of service has been decreased and the amount of supplies per person increased with very slight decrease in total operating expense. The pay roll for the year was \$172,029.52, a reduction as compared with last year of 10.1 per cent.

The total number of meals served in line hotels was 40,289 more than last year. The cost of supplies per meal was 0.57 cent more but the cost of service was 0.62 cent less, making a decrease in the total cost per meal of 0.05 cent. The total number of rations served in European laborers' messes was 37,942 less than last year. The cost of supplies per ration increased 0.16 cent but the cost of service decreased 0.72 cent, making a decrease in the total cost per ration of 0.56 cent. The total number of rations served in common laborers' kitchens was 337,243 less than last year. The cost of supplies per ration decreased 0.63 cent and the cost of service decreased 0.60 cent, making a decrease in the total cost per ration of 1.23 cents.

The average daily attendance during June, 1911, was 2,757 at the line hotels, 2,440 at the messes, and 1,154 at the kitchens. The attendance at line hotels was determined on the basis of each guest taking two meals a day, as it has been observed that the number of meals taken averages, considering all guests, about two per day. The number of laborers taking their meals at the kitchens in June, 1911, was 22.9 per cent less than in June, 1910. However, the cost of ration ticket for common laborers' kitchens has been reduced from

30 cents to 27 cents, and the number of laborers taking their meals at kitchens will probably remain about the same as at present during the rest of this year.

The following table shows the weights and costs of the principal articles consumed in the line hotels, restaurants, European laborers' messes, and common laborers' kitchens during the year:

Articles.	Quantity.	Cost.
Beef:		
Fresh.....pounds..	2,255,726	\$241,663.57
Salt.....do....	8,752	1,060.60
Bacon.....do....	54,045	13,267.63
Beans.....do....	187,333	11,677.07
Butter.....do....	118,449	37,289.32
Bread.....do....	2,442,302	97,682.98
Cocoa.....do....	25,261	5,379.62
Coffee.....do....	90,621	17,040.28
Eggs.....dozen..	185,490	55,052.28
Fish:		
Fresh.....pounds..	57,271	7,413.77
Cured.....do....	94,218	7,145.87
Flour.....do....	438,188	15,152.11
Ham.....do....	50,257	9,275.94
Lard.....do....	110,930	12,753.52
Milk.....tins....	228,132	20,572.41
Mutton:		
Fresh.....pounds..	50,588	6,738.37
Salt.....do....	15,270	1,068.46
Pork:		
Fresh.....do....	144,316	22,016.27
Salt.....do....	8,898	1,116.10
Potatoes:		
White.....do....	1,518,310	39,940.37
Sweet.....do....	308,871	5,709.15
Poultry.....do....	237,397	46,491.40
Rice.....do....	380,391	10,740.40
Sugar:		
Granulated.....do....	318,905	14,447.90
Yellow.....do....	498,967	17,517.37
Tea.....do....	8,965	2,968.50
Veal.....do....	139,044	20,573.22
Yams.....do....	84,585	2,370.59
Fruits:		
Fresh.....do....		21,372.67
Canned.....do....		22,063.06

As a result of the year's operations the line hotels and restaurants showed a loss of \$20,905.44, the European laborers' messes showed a profit of \$39,236.63, and the common laborers' kitchens showed a profit of \$14,461.95.

On November 1, 1910, the room rates at the Hotel Tivoli were reduced approximately 10 per cent. This made the rates at the Hotel Tivoli for the year very reasonable. The profit resulting from the operation of the Hotel Tivoli was \$26,427.05. The Hotel Tivoli increased its accommodations during the year and successfully took care of all large parties visiting the Isthmus. In addition to repairing equipment and replacing such minor dining-room and kitchen equipment as was necessary, we purchased for the Hotel Tivoli new furniture and linen to the amount of about \$7,000 to replace that no longer serviceable.

The following is a comparative statement of the profits and losses of the Hotel Tivoli for the years ending June 30, 1910, and June 30, 1911:

Months.	1909-10		1910-11	
	Profit.	Loss.	Profit.	Loss.
July.....		\$341. 72	\$87. 64	.....
August.....		2,396. 83		\$1,727. 86
September.....		1,727. 44		710. 81
October.....		2,776. 61		223. 18
November.....		197. 67	2,771. 76	.....
December.....		1,158. 76	804. 33	.....
January.....	\$1,618. 04		2,964. 78	.....
February.....	3,827. 04		8,594. 77	.....
March.....	4,406. 39		8,193. 02	.....
April.....	2,278. 77		2,246. 15	.....
May.....	1,146. 61		2,307. 30	.....
June.....		103. 59	1,119. 15	.....

Net profit:	
1909-10.....	\$4,574. 23
1910-11.....	26,427. 05

The following table shows weights and costs of the principal articles consumed at the Hotel Tivoli during the year:

Articles.	Quantity.	Cost.
Beef, fresh.....pounds..	39,981	\$6,746. 19
Bacon.....do....	3,344	843. 38
Beans.....do....	325	22. 00
Butter.....do....	6,237	2,202. 30
Bread.....do....	1,950	78. 00
Cocoa.....do....	319	66. 89
Coffee.....do....	3,420	855. 00
Eggs.....dozen..	13,440	4,021. 40
Fish:		
Fresh.....pounds..	19,492	2,535. 03
Cured.....do....	1,900	232. 00
Flour.....do....	44,042	1,483. 57
Ham.....do....	9,374	1,403. 37
Lard.....do....	4,870	560. 40
Milk.....tins..	20,328	1,874. 28
Mutton, fresh.....pounds..	21,875	3,718. 00
Pork:		
Fresh.....do....	2,950	487. 87
Salt.....do....	500	74. 00
Potatoes:		
White.....do....	78,929	2,152. 75
Sweet.....do....	5,935	102. 65
Poultry.....do....	24,357	5,687. 63
Rice.....do....	9,206	600. 58
Sugar, granulated.....do....	16,880	758. 85
Tea.....do....	456	130. 46
Veal.....do....	6,564	1,034. 52
Yams.....do....	5,046	142. 60
Fruits, fresh.....		4,307. 10

The total profits resulting from the subsistence operations for the year were \$59,220.19. The standard of meals served has been kept uniformly high all along the line, and the entire service at the Hotel Tivoli has been very satisfactory.

Tables showing details of the financial operations are attached hereto.

Very respectfully,

F. O. WHITLOCK,  
*Acting Subsistence Officer.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*



TABLE 1.—Statement of operations line hotels, restaurants, messes, and kitchens, July 1, 1910, to June 30, 1911.

	1910						1911						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies on hand and in transit.....	\$22,271.10	\$23,325.88	\$23,271.46	\$21,998.39	\$20,208.23	\$22,037.30	\$21,791.55	\$18,911.07	\$19,455.81	\$20,166.48	\$19,850.22	\$19,935.23	\$252,252.72
Supplies purchased.....	94,080.80	92,769.04	89,777.07	95,772.78	96,807.49	95,803.68	92,639.90	94,829.71	91,222.70	83,798.72	82,200.60	80,232.62	1,060,116.11
Supplies from hotels, messes, and kitchens.....	40,213.55	39,482.83	38,420.84	40,733.58	39,125.38	41,114.13	40,229.61	34,480.72	37,099.76	35,071.52	34,487.62	33,883.67	454,343.21
Meals served on tugs and dredges.....	65.75												65.75
Total to account for.....	156,565.45	154,577.75	151,535.12	158,504.75	156,141.10	159,055.11	154,661.06	138,221.50	147,808.27	139,027.72	136,628.44	134,061.52	1,786,777.79
Supplies to hotels, messes, and kitchens.....	40,213.55	39,482.83	38,417.36	40,733.58	39,125.38	41,114.13	40,226.11	34,480.72	37,101.20	35,074.52	34,489.37	33,878.23	454,336.98
Supplies to cleaning.....	866.69	902.01	967.82	1,000.48	981.59	1,039.10	1,059.04	982.24	1,121.62	1,052.54	1,065.74	951.82	11,990.69
Discount allowed.....	4,496.45	4,406.42	4,266.14	4,571.32	4,624.27	4,582.64	4,419.35	4,039.21	4,325.74	3,856.03	4,303.87	4,190.97	52,072.41
Credit notes.....	375.34	299.88	507.01	1,405.89	678.15	481.82	326.17	176.58	449.09	537.35	299.04	341.47	5,877.49
Supplies on hand and in transit.....	22,326.88	23,271.46	21,998.39	20,208.23	22,037.30	21,791.55	18,911.07	19,455.81	20,166.48	19,850.22	19,935.23	21,331.21	251,312.83
Pay-roll deductions.....	1.85		3.41		8.74	5.02	15.30	7.26	9.70				51.34
Total credits.....	68,299.76	68,362.60	66,160.13	67,919.50	67,455.43	69,013.96	64,987.04	59,181.82	63,173.89	60,370.66	60,063.25	60,683.70	775,641.74
Supplies consumed.....	88,296.69	86,215.15	85,374.99	90,585.25	88,685.67	90,041.15	89,704.02	79,039.68	84,634.38	78,657.06	76,545.19	73,357.82	1,011,136.05
Laundry.....	949.90	1,131.99	1,076.60	1,027.75	1,249.25	1,216.74	1,264.15	1,157.76	1,313.98	1,174.43	1,265.43	1,197.93	14,025.91
Pay roll (proportion general force, hotel, mess, and kitchen help).....	14,863.50	15,253.14	14,209.15	15,173.07	14,511.44	14,073.82	14,699.06	14,266.78	14,308.63	13,650.43	13,973.03	13,072.47	172,020.62
Cleaning.....	902.01	902.01	967.82	1,000.48	981.59	1,039.10	1,059.04	1,016.49	1,121.62	1,052.54	1,065.74	951.82	12,014.94
Coal.....	1,022.03	638.58	638.58	638.58	638.58	638.58	638.58	638.58	638.58	638.58	638.58	591.99	7,963.23
Miscellaneous.....	56.73												56.73
Electric light and power.....	100.70	100.70	92.70	92.70	92.70	92.70	93.30	93.30	91.35	91.35	81.20	133.70	1,156.40
Equipment.....	227.54	149.04	188.66	196.78	319.99	152.69	288.03	233.26	54.41	183.96	201.36	126.92	2,322.66
Permanent.....	120.16	135.69	118.21	193.50	103.66	182.85	177.29	106.66	124.10	131.20	70.68	108.93	1,631.93
Incidental.....													
Gross expense.....	18,207.25	18,316.15	17,291.72	18,322.86	17,967.21	17,396.46	18,189.45	17,511.83	17,652.67	16,922.51	17,239.43	16,183.76	211,191.32

**SUBSISTENCE DEPARTMENT.**

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Less pay-roll deductions and equipment returned.....	788.45	29	1.67	6.25	6.40	97.46	7.59	358.11
Total expense.....	17,584.41	17,394.19	18,189.45	17,510.16	16,916.11	17,141.97	16,176.17	210,338.21
Total cost of operations	108,502.94	106,642.88	107,437.34	96,549.84	96,573.17	93,057.16	89,533.99	1,221,466.26
Revenue.....	108,580.25	112,785.38	108,515.65	98,866.45	97,702.07	95,825.30	91,539.39	1,254,262.40
Total profit.....	2,077.31	4,615.67	1,078.31	2,316.61	2,128.90	2,138.14	2,006.40	32,768.14

TABLE 2.—Statement of operations line hotels and restaurants, July 1, 1910, to June 30, 1911.

	1910							1911							Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.			
Supplies on hand and in transit.....	\$20,678.23	\$20,747.88	\$21,631.11	\$20,822.93	\$18,896.79	\$20,853.42	\$20,520.27	\$17,713.44	\$18,285.47	\$18,909.10	\$18,376.71	\$17,962.76	\$235,399.11		
Supplies purchased.....	86,332.08	84,492.68	82,335.42	87,497.80	90,157.36	91,133.38	88,272.26	80,889.64	86,374.78	78,461.50	76,357.40	75,357.45	1,006,611.70		
Supplies from hotels, messes, and kitchens.....	6,687.61	6,019.06	5,444.31	6,199.62	5,716.11	5,960.81	6,010.99	5,421.61	6,560.49	6,339.34	6,759.19	6,367.74	73,508.87		
Meals served on tugs and dredges.....			65.75										65.75		
Total to account for.....	112,688.87	111,259.61	109,476.59	114,520.35	114,770.26	117,967.61	114,803.52	103,974.69	111,220.74	103,709.94	101,493.30	99,687.95	1,315,583.43		
Supplies to hotels, messes, and kitchens.....	38,217.33	37,348.54	36,649.15	38,811.33	37,272.94	39,192.02	38,505.94	32,901.55	35,110.63	33,012.43	32,302.90	31,688.78	431,013.54		
Supplies to cleaning.....	514.66	520.22	574.36	577.48	578.62	617.07	645.28	613.76	709.60	696.55	665.25	617.66	7,328.40		
Discount allowed.....	3,784.60	3,663.99	3,521.20	3,814.13	3,911.18	3,941.62	3,844.82	3,496.06	3,716.32	3,379.53	3,566.07	3,334.87	44,196.88		
Credit notes.....	370.13	290.68	448.06	1,347.28	663.19	413.65	310.97	164.46	422.36	401.20	290.27	388.62	5,451.07		
Supplies on hand and in transit.....	20,747.88	21,631.11	20,822.93	18,896.79	20,853.42	20,520.27	17,713.44	18,285.47	18,909.10	18,376.71	17,962.76	19,588.86	234,308.74		
Total credits.....	63,634.40	63,444.84	62,015.69	63,447.01	63,269.35	64,694.63	61,018.45	55,454.30	58,867.91	55,866.71	54,816.25	55,768.79	722,288.33		
Supplies consumed.....	49,064.47	47,814.77	47,460.90	51,073.34	51,500.91	53,282.98	53,785.07	46,520.39	52,352.83	47,843.23	46,677.06	43,919.16	593,295.10		
Laundry.....	886.62	1,064.66	992.01	926.81	1,122.59	1,060.79	1,137.57	1,039.45	1,177.55	1,068.93	1,137.89	1,076.32	12,719.18		
Pay roll:															
Proportion general force.....	1,353.03	1,714.31	1,335.94	1,968.76	1,533.24	1,385.96	1,770.46	1,488.06	1,602.62	1,267.28	1,787.81	1,350.68	18,518.16		
Hotel help.....	7,551.92	7,475.29	7,360.88	7,867.11	7,551.42	7,638.42	7,768.71	7,928.06	7,862.22	7,708.66	7,417.67	7,347.75	91,174.11		
Cleaning.....	514.56	520.52	574.35	577.48	578.62	617.07	645.28	626.14	709.50	696.55	665.25	617.66	7,343.78		
Miscellaneous.....	56.73												56.73		
Gross expense.....	10,371.86	10,774.57	10,263.18	10,869.16	10,785.87	10,742.24	11,308.04	11,032.64	11,441.95	10,821.42	11,068.62	10,362.41	129,811.96		
Less payroll deductions.....				13.67		.29							13.96		
Total expense.....	10,371.86	10,774.57	10,263.18	10,885.49	10,785.87	10,741.95	11,308.04	11,032.64	11,441.95	10,821.42	11,068.62	10,362.41	129,798.00		
Total cost of operation.....	59,436.33	58,689.34	57,724.06	61,998.83	62,266.78	64,024.96	65,093.11	59,563.03	68,794.78	58,664.66	57,686.67	54,311.57	723,062.10		
Coupons, 30-cent.....	54,441.98	54,224.60	53,286.60	57,568.50	56,779.80	58,048.20	60,476.80	54,861.60	59,236.99	54,219.90	53,219.90	49,885.40	695,238.95		
Cash.....	84,970.78	912.36	1,066.40	1,982.80	1,186.87	1,224.82	1,373.81	1,366.76	1,794.66	1,364.76	1,368.10	1,254.70	14,746.50		
Hotels, 40-cent.....				24.00	22.20	26.40	30.80	27.60	32.60	32.40	24.80	10.40	232.20		
Sanitary department.....	61.62	72.60	45.01	44.36	40.23	54.41	41.34	39.68	32.60	56.15	64.83	46.46	867.69		
Civil administration.....	1,046.40	1,062.75	1,014.90	1,072.40	1,066.55	1,166.00	1,060.50	1,007.75	1,066.60	1,102.71	1,171.80	1,131.96	13,047.31		
Third division.....					.60								.60		

Construction and engineering	143.40	144.90	532.73	603.00	605.70	570.90	572.40	531.10	557.70	490.30	462.45	399.60	5,634.18
Young Men's Christian Association.	44.80	35.88	44.42	49.70	50.84	57.04	76.33	112.30	129.02	107.40	102.03	222.64	1,033.05
Panama R. R.	3.90	11.50	3.60	3.70	1.90	1.90	22.53	22.53	14.40	6.30	6.30	2.10	60.92
Tugs and dredges.			79.90	7.40	18.00	17.25	7.60	11.00	9.15	8.35	8.60	8.70	175.94
Marine Corps.					19.80				6.60	29.70			19.80
Red Cross.													26.30
Meals furnished Isthmian Canal Commission band.	10.80												120.80
Fourth of July committee.	110.00				51.70				193.00	1.50			246.20
Meals served for Hotel Tivoli.													
Gross revenue.	56,832.50	56,474.53	56,076.56	60,355.86	59,863.89	61,164.02	63,568.58	57,972.32	63,108.73	57,420.56	56,438.96	52,912.45	702,189.01
Less miscellaneous deductions.					.50	.55							1.35
Total revenue.	56,832.50	56,474.53	56,076.56	60,355.86	59,863.39	61,163.17	63,568.58	57,972.32	63,108.73	57,420.56	56,438.96	52,912.45	702,187.66
Net loss.	2,603.82	2,114.76	1,647.52	1,572.97	2,423.39	2,861.76	1,324.53	1,590.71	686.05	1,244.09	1,246.71	1,399.12	20,905.44
Number of meals served.	178,352	178,577	177,368	191,013	189,887	193,352	201,545	183,612	199,500	180,869	177,204	165,461	2,216,749
Cost supplies per meal.	26.01	25.50	25.47	25.49	25.88	26.25	25.49	25.22	24.96	25.05	24.88	24.95	25.44
Cost service per meal.	5.57	5.78	5.56	5.46	5.47	5.34	5.43	5.78	5.52	5.70	5.89	5.93	5.61
Total cost per meal, cents.	31.58	31.28	31.03	30.95	31.35	31.59	30.91	31.00	30.48	30.76	30.77	30.88	31.05

TABLE 3.—Statement of operation, European laborers' messes, July 1, 1910, to June 30, 1911.

	1911												Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies on hand and in transit.....	\$1,591.87	\$1,578.00	\$1,640.35	\$1,175.46	\$1,311.44	\$1,183.88	\$1,271.28	\$1,197.63	\$1,200.34	\$1,257.38	\$1,473.51	\$1,972.47	\$16,853.81
Supplies purchased.....	1,044.51	6,751.70	6,008.20	6,130.00	5,711.31	4,770.80	4,397.64	3,198.07	4,847.92	5,328.22	5,933.20	4,873.17	46,551.33
Supplies from hotels, messes, and kitchens.....	25,362.38	25,534.34	25,530.38	26,869.57	25,506.88	26,270.02	25,971.74	22,338.29	23,553.19	21,004.71	20,452.41	20,073.42	289,123.33
Total to account for.....	33,998.75	33,850.04	33,176.02	34,975.03	32,529.63	32,224.20	31,610.66	27,525.99	29,571.45	28,290.31	27,859.12	26,923.06	372,534.27
Supplies to hotels, messes, and kitchens.....	1,996.22	2,134.29	1,768.21	1,822.25	1,832.44	1,922.11	1,720.17	1,579.17	1,900.57	2,062.09	2,186.47	2,180.45	23,323.44
Supplies to cleaning.....	3,278.93	2,988.69	3,177.08	3,400.64	3,335.56	3,411.62	3,522.64	3,224.05	3,600.68	3,918.01	3,848.40	3,300.57	37,019.26
Dormitory allowed.....	701.98	762.43	744.04	757.19	713.09	641.02	573.53	550.15	609.42	598.22	706.80	664.10	8,007.84
Credit notes.....	5.21	9.00	58.55	58.61	24.98	67.87	13.20	12.12	28.73	14.14	8.77	2.85	304.41
Supplies on hand and in transit.....	1,578.00	1,640.35	1,173.46	1,311.44	1,183.88	1,271.28	1,197.63	1,200.34	1,257.38	1,473.51	1,972.47	1,742.35	17,004.09
Payroll deductions.....	.....	.....	3.41	.....	8.74	4.57	11.51	5.83	9.76	.....	.....	.....	44.21
Total credits.....	4,560.68	4,824.76	4,068.05	4,390.43	4,118.67	4,248.47	3,871.68	3,671.68	4,254.54	4,461.97	5,241.00	4,801.32	52,603.25
Supplies consumed.....	29,438.06	29,025.28	29,107.97	30,584.60	28,410.96	27,975.73	27,738.98	23,854.31	25,316.91	23,828.34	22,618.12	22,031.74	319,931.02
Laundry.....	38.12	46.78	59.65	72.15	89.64	91.81	91.33	84.04	99.57	82.08	91.00	91.31	837.48
Pay roll.....	863.04	1,180.94	961.19	1,322.14	954.46	822.73	998.10	787.44	855.47	994.62	980.46	751.55	11,151.04
Proportion general force.....	3,611.56	3,375.48	3,236.36	3,140.02	3,173.81	2,999.59	2,971.91	3,047.81	2,847.46	2,904.01	2,792.42	2,658.08	36,755.51
Cleaning.....	273.93	288.69	317.08	340.94	335.56	341.62	352.64	324.05	360.68	341.01	364.40	300.57	3,919.26
Coal.....	768.98	480.90	496.88	487.88	484.33	482.17	487.95	491.03	494.43	498.48	457.33	440.49	6,083.06
Electric light and power.....	88.80	88.80	80.80	80.80	80.80	80.80	76.50	76.50	75.15	75.15	66.80	93.05	6,983.95
Equipment.....	222.81	120.84	174.60	173.41	313.56	122.67	284.66	222.01	54.41	182.62	177.16	128.92	2,180.57
Incidental.....	113.25	106.60	113.30	190.71	138.01	171.06	160.71	96.00	108.58	126.76	60.09	98.35	1,475.42
Gross expense.....	5,985.47	5,689.03	5,429.84	5,813.03	5,570.17	5,112.45	5,423.80	5,129.15	4,893.75	4,874.53	4,969.75	4,565.32	63,456.29
Less payroll deductions and equipment returned.....	.....	.....	.....	724.36	.....	.....	.....	1.67	6.25	6.40	94.29	7.59	840.56
Total expense.....	5,985.47	5,689.03	5,429.84	5,088.67	5,570.17	5,112.45	5,423.80	5,127.48	4,887.50	4,868.13	4,875.46	4,557.73	62,615.73
Total cost of operation.....	35,423.55	34,714.31	34,537.81	35,673.27	33,981.13	33,088.18	33,162.78	28,981.79	30,204.41	28,696.47	27,493.58	26,580.47	392,546.75
Tickets.....	39,109.95	38,934.99	38,900.34	40,434.70	37,226.20	36,051.37	36,604.63	31,854.60	34,177.50	31,553.94	30,340.50	29,419.18	424,607.81
Sanitary department.....	296.27	273.73	238.83	256.40	281.33	271.87	231.73	222.67	293.73	293.73	238.27	203.06	3,005.60
Civil administration.....	12.50	32.30	34.40	35.80	32.60	38.30	35.30	34.90	37.60	28.89	32.58	32.04	388.21
Third division.....	2.80	39.33	117.20	152.00	127.87	136.53	64.40	84.13	134.53	79.33	106.40	75.60	1,120.12
Red Cross.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.93

[illegible]

TABLE 4.—Statement of operation, common laborers' kitchens, July 1, 1910, to June 30, 1911.

	1910						1911						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies purchased.....	\$1,704.26	\$1,528.66	\$1,436.36	\$1,344.98	\$933.82	.....	.....	.....	.....	.....	.....	.....	\$6,953.08
Supplies from hotels, messes, and kitchens..	8,163.56	7,939.44	7,446.15	7,664.39	7,902.39	\$6,963.30	\$8,246.88	\$6,720.82	\$7,016.08	\$7,027.47	\$7,276.02	\$7,440.51	91,707.01
Total to account for.....	9,867.82	9,468.10	8,882.51	9,009.37	8,841.21	8,963.30	8,246.88	6,720.82	7,016.08	7,027.47	7,276.02	7,440.51	98,660.09
Supplies to cleaning.....	73.20	93.00	76.39	82.06	67.41	80.41	63.12	54.43	51.44	41.96	26.00	33.59	743.03
Pay-roll deductions.....	1.48	.....	.....	.....	.....	45	3.79	1.41	.....	.....	.....	.....	7.13
Total credits.....	74.68	93.00	76.39	82.06	67.41	80.86	66.91	55.84	51.44	41.98	26.00	33.59	750.16
Supplies consumed.....	9,793.14	9,375.10	8,806.12	8,927.31	8,773.80	8,782.44	8,179.97	6,664.98	6,964.64	6,985.49	7,250.02	7,406.02	97,909.93
Laundry.....	16.16	20.56	24.94	26.79	37.02	34.14	35.25	34.27	36.86	33.42	36.54	30.30	399.25
Pay roll.....	296.51	398.84	300.00	408.42	331.85	266.94	308.01	236.07	249.32	198.45	282.46	238.24	3,506.11
Proportion general force.....	1,187.44	1,123.28	1,014.78	938.62	966.66	960.18	863.85	831.41	801.48	788.51	732.21	728.17	10,924.59
Kitchen help.....	73.20	83.00	76.39	82.06	67.41	80.41	63.12	54.43	51.44	41.98	26.00	33.59	751.80
Cleaning.....	233.07	157.68	151.72	150.72	154.25	156.41	150.63	147.28	144.15	142.10	134.66	142.50	1,885.17
Coal.....	11.90	11.90	11.90	11.90	11.90	11.90	16.80	16.80	16.20	16.20	14.40	40.65	192.45
Electric light and power.....	4.73	28.20	14.06	18.37	6.43	30.02	3.37	11.25	1.46	1.46	24.20	12.58	142.09
Equipment.....	6.91	29.06	4.91	2.79	25.65	11.79	16.58	9.66	17.52	4.44	10.59	.....	152.51
Incidental.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gross expense.....	1,840.92	1,852.55	1,598.70	1,640.67	1,601.17	1,541.79	1,457.61	1,350.04	1,316.97	1,226.56	1,261.06	1,236.03	17,923.07
Less pay-roll deductions and equipment returned.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.17	.....	3.59
Total expense.....	1,840.92	1,852.55	1,598.70	1,640.67	1,601.17	1,541.79	1,457.61	1,350.04	1,316.97	1,226.56	1,257.89	1,236.03	17,919.48
Total cost of operation.....	11,643.06	11,227.65	10,404.82	10,567.56	10,374.97	10,324.23	9,637.58	8,015.02	8,281.61	8,212.05	8,507.91	8,632.95	115,529.41
Tickets.....	11,592.50	11,188.60	10,394.50	10,510.60	10,405.10	10,021.80	9,841.30	8,235.20	8,320.00	7,576.53	7,836.03	8,114.85	114,037.01
Sanitary department.....	102.20	99.20	82.20	88.40	80.80	97.10	64.70	91.90	150.80	81.36	58.31	80.46	1,072.63
Civil administration.....	1,340.85	1,377.45	1,175.55	1,125.00	904.83	1,146.75	1,016.00	878.60	1,021.30	1,051.09	986.30	831.15	12,863.34
Third division.....	12.50	9.30	8.40	11.90	2.10	7.70	1.80	1.30	1.50	1.09	.....	6.75	56.54
Construction and engineering.....	.....	11.10	304.10	517.70	502.10	383.00	375.40	332.70	367.30	403.92	454.95	460.71	4,112.88
Quartermasters' department.....	.....	.....	.....	.....	.....	.....	.....	.....	1.90	.....	.....	.....	1.90
Mess kits.....	4.20	5.40	2.40	1.50	.....	.....	1.80	1.20	82.50	.....	2.40	.....	90.70
Red Cross.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20.70
Gross revenue.....	13,052.25	12,661.05	11,967.15	12,250.30	11,885.83	11,648.35	11,300.00	9,540.90	9,945.60	9,123.97	9,348.99	9,493.92	132,257.31

Less transfer tickets.....	161.30	183.60	139.60	175.70	174.40	188.00	196.70	162.80	156.00	126.81	151.20	149.94	1,905.95
Total revenue.....	12,890.95	12,537.45	11,827.65	12,074.60	11,721.43	11,460.35	11,103.30	9,378.10	9,786.60	8,993.16	9,197.79	9,343.98	130,291.36
Total profit.....	1,247.89	1,279.80	1,422.83	1,507.04	1,346.46	1,136.12	1,405.72	1,363.08	1,507.99	784.11	689.88	711.03	14,461.95
Number of rations served.....	42,970	41,601	39,426	40,249	39,071	38,201	37,010	31,260	32,633	33,319	34,066	34,607	444,533
Cost of supplies per ration.....	22.79	22.49	22.34	22.18	22.45	22.99	22.10	21.32	21.12	20.97	21.90	21.40	22.03
Cost of service per ration.....	4.31	4.44	4.06	4.08	4.10	4.04	3.94	4.32	4.04	3.68	3.82	3.64	4.03
Total cost per ration.....	27.10	26.93	26.39	26.26	26.55	27.03	26.04	25.64	25.16	24.65	25.72	24.94	26.06



TABLE 5.—Statement of operation, Hotel Tivoli, July 1, 1910, to June 30, 1911.

	1910						1911						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies on hand and in transit.....	\$2,064.20	\$2,248.28	\$2,088.28	\$2,283.62	\$2,739.47	\$2,585.83	\$2,911.69	\$3,250.71	\$3,371.03	\$3,160.28	\$2,733.75	\$2,637.71	\$32,044.86
Supplies purchased.....	4,586.23	3,337.74	3,988.02	4,332.90	5,767.50	5,623.78	6,145.61	7,392.90	8,862.90	4,981.55	4,866.13	4,726.00	64,614.26
Supplies from hotels, messes, and kitchens.....							.75	18.00	1.44	3.00	1.75		24.94
Total to account for.....	6,650.43	5,586.02	6,076.30	6,586.52	8,506.97	8,209.61	9,058.05	10,661.61	12,235.37	8,144.83	7,601.63	7,366.71	96,684.05
Supplies to quarters.....	121.50	111.44	107.22	76.13	98.48	95.87	70.93	126.28	166.67	150.44	171.41	107.03	1,403.40
Supplies to cleaning.....	24.79	49.92	33.07	40.51	33.49	37.22	46.86	78.68	57.96	40.36	46.02	38.03	526.91
Supplies on hand and in transit.....	2,248.28	2,088.28	2,233.62	2,739.47	2,585.83	2,911.69	3,250.71	3,371.03	3,160.28	2,733.75	2,637.71	2,650.12	32,990.77
Credit notes.....	7.12	5.32	151.55	39.61	1.60	36.27	21.18	10.70	15.01	49.59	3.25	8.44	349.64
Supplies to hotels, messes, and kitchens.....			3.48				4.25	18.00				5.44	31.17
Total credits.....	2,401.69	2,254.96	2,548.94	2,865.72	2,719.40	3,081.05	3,383.93	3,604.69	3,399.92	2,974.14	2,853.39	3,106.06	35,241.89
Supplies consumed.....	4,248.74	3,331.06	3,527.36	3,690.80	5,787.57	5,128.56	5,664.12	7,056.92	8,835.45	5,170.69	4,743.24	4,257.65	61,442.16
Pay roll, proportion general force and hotel help.....	2,098.78	2,298.73	2,161.91	2,327.46	2,594.76	2,572.05	2,640.68	3,108.44	3,477.09	2,916.33	2,680.24	2,632.77	31,509.24
Equipment.....	170.42	818.37	818.56	107.42	793.37	1,009.04	1,128.43	1,096.65	698.14	224.19	11.45	35.22	6,861.26
Permanent.....	86.36	171.93	83.87	144.43	329.64	817.14	599.71	151.58	141.18	130.03	130.99	102.21	2,894.12
Incidental.....	418.40	408.50	402.97	374.07	553.51	496.62	569.78	626.87	898.50	590.11	586.67	560.99	6,456.99
Laundry.....	24.79	49.92	33.07	40.51	33.49	37.22	46.86	78.68	57.96	40.36	46.02	38.03	526.91
Cleaning.....	121.50	111.44	107.22	76.13	98.48	95.87	70.93	126.28	166.67	150.44	171.41	107.03	1,403.40
Supplies to quarters.....	121.46	108.63	108.63	121.46	121.53	121.46	121.39	121.39	121.46	108.63	114.46	114.32	1,404.82
Coal.....	155.22	135.98	119.86	120.30	169.90	166.14	152.62	110.54	213.70	177.18	196.28	172.44	1,883.16
Electric light and power.....	34.50	49.55	23.20	115.40	14.60	117.80	277.35	78.27	113.39	28.02	60.64	70.40	983.42
Miscellaneous.....													
Gross expense.....	3,231.43	4,153.35	3,859.29	3,427.23	4,709.28	5,433.34	5,607.75	5,438.70	5,538.09	4,365.29	3,991.16	3,833.41	53,908.32
Less pay-roll deductions and equipment returned.....	1.31		1.34	.85	2.11	5.43	1.10	2.44	3.66	64.43	354.45	1.96	439.08
Total expense.....	3,230.12	4,153.35	3,857.95	3,426.38	4,707.17	5,427.91	5,606.65	5,436.26	5,534.43	4,300.86	3,636.71	3,831.45	53,469.24
Total cost of operation.....	7,478.86	7,484.41	7,385.31	7,117.18	10,494.74	10,556.47	11,270.77	12,493.18	14,069.88	9,471.55	8,379.95	8,086.10	114,911.40
Revenue.....	7,566.50	7,566.55	6,674.50	6,894.00	13,266.50	11,800.80	14,235.55	21,087.95	22,892.90	11,717.70	10,687.25	9,208.25	141,338.45
Subsistence profits.....							741.10	4,002.67	3,886.50	8.85	55.18		8,994.30
Subsistence loss.....													6,907.68

Cigar-stand profit.....	186.26	188.18	142.10	29.79	341.99	283.77	401.18	683.58	821.03	156.35	272.40	196.74	3,713.37
Quarters profit.....	1,019.73	176.82	713.72	618.53	2,540.57	1,189.86	1,822.50	3,908.52	3,485.49	2,080.95	1,979.72	1,390.65	20,927.06
Profit.....	87.64				2,771.76	804.33	2,964.78	8,594.77	8,193.02	2,246.15	2,307.30	1,119.15	28,088.90
Loss.....		1,727.86	710.81	223.18									2,661.85
Total profit.....													26,427.05
Number of meals served.....	6,059	5,217	5,739	6,497	10,611	9,078	11,277	15,699	17,684	9,268	8,562	7,758	113,527
Cost supplies per meal.....	65.17	59.94	57.43	51.11	48.78	51.85	46.30	40.00	44.01	55.50	49.36	51.06	49.09
Cost service per meal.....	27.09	43.25	36.45	27.89	24.81	27.92	20.33	17.20	16.33	24.94	23.21	25.73	24.00
Total cost per meal.....	92.86	103.19	93.88	79.00	73.59	79.77	66.63	57.20	60.34	80.44	72.57	76.79	73.09

TABLE 7.—Summary of operation, Hotel Tivoli, July 1, 1910, to June 30, 1911.

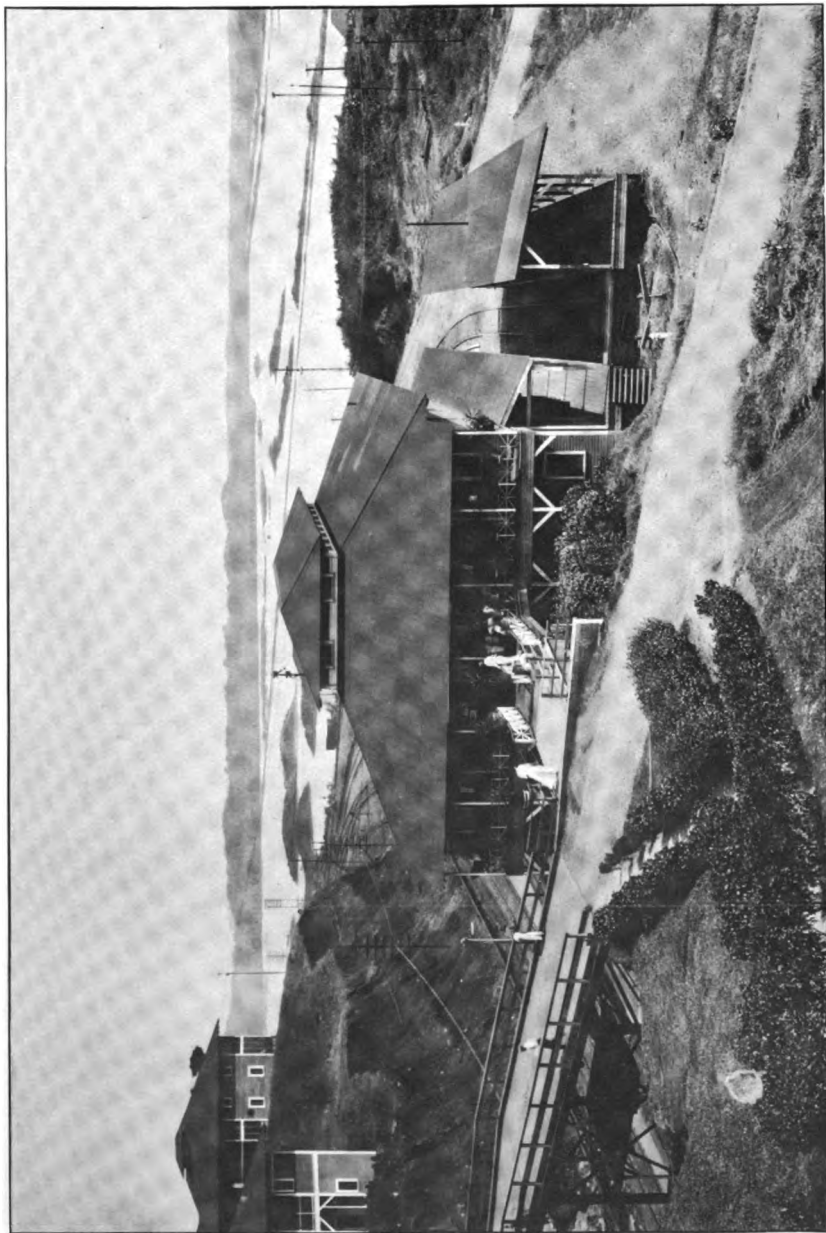
	Supplies consumed.	Laundry.	Pay roll.		Miscellaneous.	Fuel.	Light.	Equipment.		Total cost of operations.	Cash.	Contingents.	D.O. collections.	Accounts.	Total revenue.	Profit.	Loss.	Meals served.
			General office.	Line, gold and silver.				Straight.	Expendable.									
1910—July.....	\$4,248.74	\$418.40	\$181.38	\$1,937.42	\$180.79	\$121.46	\$155.22	\$180.11	\$98.36	\$7,478.88	\$6,987.65	\$804.40	\$24.75	\$220.30	\$7,548.50	\$87.64	.....	34,089
August.....	3,831.08	408.50	102.64	2,136.09	211.21	108.63	138.88	818.37	171.83	7,494.31	5,594.90	984.30	40.26	1,537.55	6,756.55	.....	\$1,737.36	5,297
September.....	3,827.80	402.07	119.90	2,042.01	163.40	108.63	119.80	817.22	183.87	7,385.31	5,408.81	778.70	40.26	519.48	6,574.00	.....	170.81	6,429
October.....	3,960.80	373.51	238.02	2,386.13	224.54	121.53	120.30	106.57	144.43	7,117.13	5,437.86	520.50	40.26	1,178.93	6,594.00	.....	223.18	10,611
November.....	5,027.54	483.62	210.72	2,365.58	246.89	121.53	120.30	731.26	329.64	10,564.74	12,209.00	770.60	40.26	1,200.26	11,308.50	2,771.76	.....	9,078
December.....	5,128.19	486.78	248.12	2,371.58	268.24	121.53	120.30	1,008.51	317.11	10,576.77	12,209.00	770.60	40.26	1,200.26	11,308.50	2,771.76	.....	11,278
1911—January.....	5,464.12	506.78	402.34	2,702.10	288.23	121.53	110.54	1,008.51	317.11	11,276.76	12,209.00	770.60	40.26	1,200.26	11,308.50	2,771.76	.....	15,609
February.....	5,833.46	988.50	420.27	2,715.16	338.02	121.53	110.54	1,008.51	317.11	12,488.88	14,562.30	984.80	40.26	1,144.70	21,687.00	8,504.77	.....	17,684
March.....	5,170.80	590.11	204.74	2,715.16	218.82	121.53	110.54	1,008.51	317.11	14,488.88	14,562.30	984.80	40.26	1,144.70	21,687.00	8,504.77	.....	2,264
April.....	5,743.94	580.47	244.22	2,424.09	278.07	114.46	159.28	1,008.51	317.11	8,571.64	11,200.40	466.50	7.25	1,136.90	10,587.25	2,267.12	.....	8,562
May.....	4,257.65	560.99	188.53	2,474.24	218.46	114.32	172.44	1,008.51	317.11	8,571.64	11,200.40	466.50	7.25	1,136.90	10,587.25	2,267.12	.....	7,758
June.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	61,442.16	456.99	2,800.19	28,006.52	913.73	1,404.82	1,883.16	6,412.18	2,889.12	114,911.40	132,158.77	7,569.90	617.35	992.43	141,538.45	47,052.05	.....	113,527

¹ Debit: This amount is preceding month's excess over current month.

² Credit: This amount returned in excess of amount received.

	Supplies consumed.	total expend.	Profit.	Loss.	Meals served.	Rations served.
<i>Line hotels and restaurants.</i>						
1910—July.....	\$49,064.47	,832.50	.....	\$2,603.83	\$178,352	.....
August.....	47,814.77	,474.58	.....	2,114.76	178,577	.....
September.....	47,460.90	,076.56	.....	1,647.52	177,368	.....
October.....	51,073.34	,355.86	.....	1,572.97	191,013	.....
November.....	51,500.91	,863.39	.....	2,423.39	189,887	.....
December.....	53,282.98	,163.17	.....	2,861.76	193,352	.....
1911—January.....	53,785.07	,568.58	.....	1,524.53	201,545	.....
February.....	48,520.39	,972.32	.....	1,580.71	183,612	.....
March.....	52,352.83	,108.73	.....	686.06	199,500	.....
April.....	47,843.23	,420.56	.....	1,244.09	180,869	.....
May.....	46,677.06	,438.96	.....	1,246.71	177,204	.....
June.....	43,919.16	,912.45	.....	1,399.12	166,461	.....
Total.....	593,295.10	,187.66	.....	20,905.44	2,216,740	.....
<i>European laborers' messes.</i>						
1910—July.....	29,438.08	,856.80	\$3,433.25	.....	.....	\$97,142
August.....	29,025.28	,637.46	3,923.15	.....	.....	95,593
September.....	29,107.97	,716.33	4,178.52	.....	.....	95,791
October.....	30,584.60	,354.87	4,681.60	.....	.....	100,971
November.....	28,410.96	,190.00	3,208.87	.....	.....	92,975
December.....	27,975.73	,892.13	2,803.95	.....	.....	89,733
1911—January.....	27,738.98	,067.40	2,894.62	.....	.....	90,144
February.....	23,854.31	,516.03	2,534.24	.....	.....	78,790
March.....	25,316.91	,806.50	3,601.09	.....	.....	84,514
April.....	23,828.34	,285.25	2,588.88	.....	.....	78,214
May.....	22,618.12	,188.55	2,694.97	.....	.....	75,471
June.....	22,031.74	,282.96	2,693.49	.....	.....	73,207
Total.....	319,931.02	,783.38	39,236.63	.....	.....	1,054,545
<i>Common laborers' kitchens.</i>						
1910—July.....	9,793.14	,890.95	1,247.89	.....	.....	42,970
August.....	9,375.10	,507.45	1,279.80	.....	.....	41,091
September.....	8,806.12	,827.65	1,422.83	.....	.....	39,426
October.....	8,927.31	,074.60	1,507.04	.....	.....	40,249
November.....	8,773.80	,721.43	1,346.46	.....	.....	39,071
December.....	8,782.44	,480.35	1,136.12	.....	.....	38,201
1911—January.....	8,179.97	,103.30	1,465.72	.....	.....	37,010
February.....	6,664.96	,378.10	1,363.08	.....	.....	31,269
March.....	6,964.64	,789.60	1,507.99	.....	.....	32,533
April.....	6,965.49	,996.16	784.11	.....	.....	33,319
May.....	7,250.02	,197.79	689.88	.....	.....	34,095
June.....	7,406.92	,343.98	711.03	.....	.....	34,607
Total.....	97,909.93	,291.36	14,461.95	.....	.....	444,503
Grand total.....	1,011,136.05	,262.40	32,793.14	20,905.44	2,216,740	1,499,048





COMMISSARY AT GATUN, JUNE, 1911.



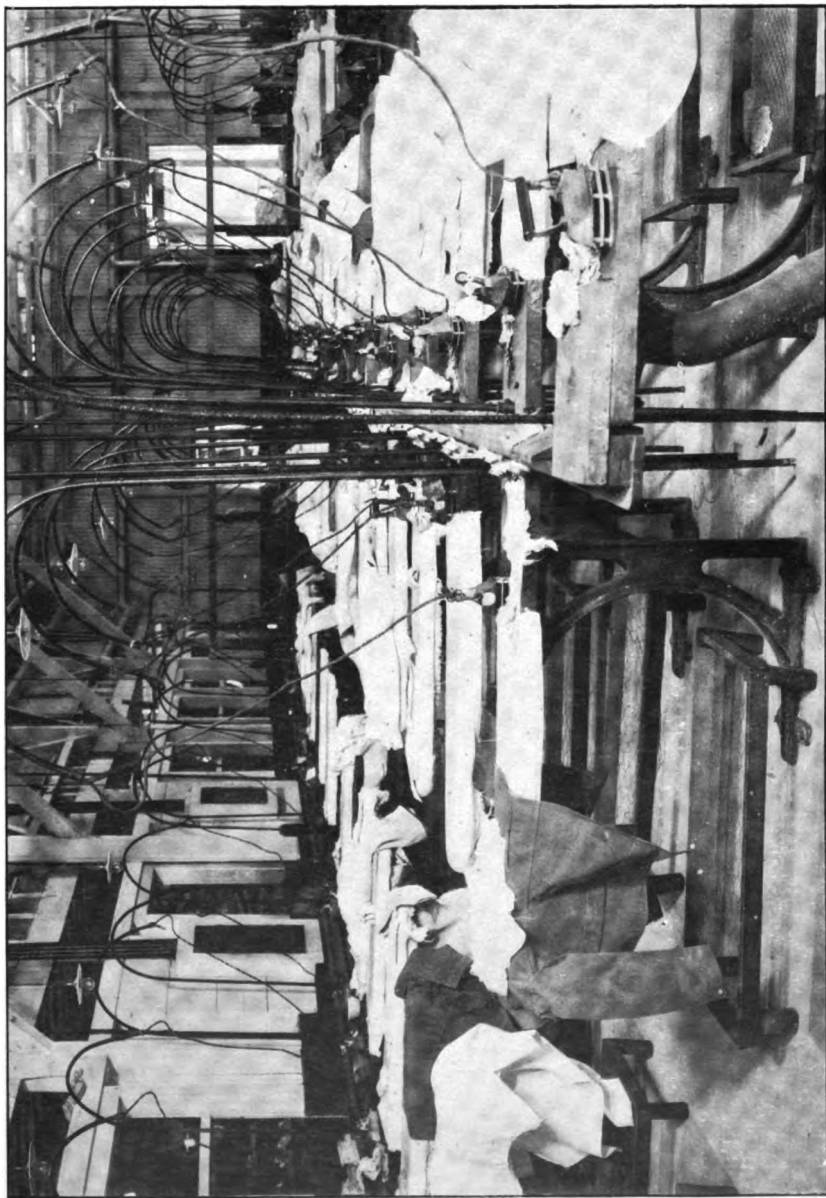
PLATE 75.



INTERIOR OF COMMISSARY AT GATUN, JUNE, 1911.







INTERIOR OF LAUNDRY AT CRISTOBAL.



## APPENDIX L.

### REPORT OF H. A. A. SMITH, EXAMINER OF ACCOUNTS.

ISTHMIAN CANAL COMMISSION,  
*Empire, Canal Zone, August 10, 1911.*

SIR: I have the honor to submit the following report of the business of the department of examination of accounts, including the duties performed as auditor of the government of the Canal Zone, for the fiscal year ended June 30, 1911. As I did not arrive on the Isthmus to take charge of this department until May 19, 1911, this is largely a report of the operations of the office under the direction of my predecessor, Mr. W. W. Warwick.

The organization of the department, for convenience in handling the work assigned it, is divided into the following divisions: General accounts, which involves the bookkeeping, accounts receivable, miscellaneous collections, and an analysis of reports of construction divisions and accounts of the disbursing officer on the Isthmus and at Washington; pay-roll division, including the unpaid salaries and wages accounts and the monthly checking of timekeeping offices; voucher division, including the administrative examination of the account of the disbursing officer on the Isthmus; injury claims division; division of Canal Zone accounts; time inspection; subsistence accounting; contract laborers; and files and bonds of employees. A number of employees are not permanently assigned to any one division, as they are used so as to best meet the requirements of the work at different periods of the month. The plan of organization is well adapted to secure good results from the work and but few changes of a minor character have been made.

During the past year the work of bookkeeping and maintaining the record of classified expenditures has been executed along lines uniform with those of the preceding fiscal year, during which the present revised system of accounts and classification has been in effect. The value of the reclassification put into operation by this department under your direction on July 1, 1909, increases with each fiscal year, and has made it possible to state the expenditures of the Isthmian Canal Commission under a uniform classification from the beginning of the work to the present time. The distribution of the accumulated plant charges as made by this office, effective July 1, 1909, has shown its advantage by the results whereby each unit of the work has been made to absorb in its cost the value of such plant as has been applied or used therein. The number of bills rendered against employees and other individuals and companies has been gradually reduced by improved methods of collections, by deductions, and otherwise. The past fiscal year shows a monthly average of 385 bills rendered which, in view of the increased volume of business during that period, is a considerable decrease. A special effort has been made to keep the uncollected accounts to a minimum.

The accounts of all bonded employees charged with the collection of revenues due the commission have been audited and balanced each month.

The accounting for the issuing of commissary and hotel coupon books and meal tickets for colored and European laborers, and the operations of hotels, messes, and kitchens, involves considerable detail in examining and settling the accounts of issuing clerks and stewards. Under the present system, which has been in effect with but few changes for the past three years, coupon books and meal tickets are issued by the disbursing officer on requisition of bonded employees after approval by this office, and the method has worked successfully during that period. Upon the recommendation of this office in January, 1910, the use of separate meal tickets for each department or division was discontinued and uniform tickets of 30 and 40 cent denominations, without department or division designation, were substituted. This plan has been successful and resulted in saving fully one-half the time in making and checking the reports of stewards in charge of messes and kitchens. There are 52 employees of the commission who are accountable for the issue of coupon books and meal tickets, but in most cases the issue of and accounting for these books and tickets forms only a part of their duties. During the past fiscal year the work involved the issue of over 520,000 coupon books and 1,428,000 meal tickets. The use of commissary coupon books increases the sales of goods and enables the commissaries to make better prices on the goods sold therein. If the issue of these books is to continue, I recommend that such expense as is incurred in the issuing and accounting for commissary coupon books be paid by the Panama Railroad Co. in the form of a fixed monthly charge.

The decrease in the number of claims that were rendered against the commission, which were principally due to an effort to consolidate aggregations of smaller accounts into one and the rendition of a monthly claim by an individual rather than several smaller ones during the same period, shows that improvements in handling claims are still being made. During the past year 2,788 claims were audited and vouchers prepared involving the disbursement of over \$10,077,000, while during the preceding fiscal year 3,706 claims were audited and paid, amounting to a little less than \$10,000,000. At the close of business June 30, 1911, there were unpaid claims on hand amounting to \$454,000. Of this amount, \$426,000 represents the bill of the Panama Railroad Co. for the value of the stock of material transferred to the commission. The verification of this bill was not completed on June 30. There have been 441 claims for unpaid salaries and wages due the estates of deceased employees of the Isthmian Canal Commission examined, of which 348 were paid, amounting to \$8,281.50.

The required administrative examination of the disbursing officer's account has been made monthly. This examination is practically limited to an examination of the receipts which the disbursing officer obtains for the funds disbursed, as all claims are audited prior to payment, this office passing to the disbursing officer all claims against the Isthmian Canal Commission, including pay rolls, in the form of completed and approved vouchers for payment. During a part of this period a very careful check was made of the 35,000 pay receipts

for salaries and wages which were paid each month, in order to keep pace with more exacting requirements of the accounting officials of the Treasury Department in Washington.

A careful permanent record is being maintained of all unpaid salaries and wages due employees of the commission, and this record is growing larger each year. In the majority of instances the amounts due employees who have left the work are small, and claims are frequently presented for salaries and wages earned from one to six years earlier. On June 30, 1911, there were outstanding items of unpaid salaries and wages amounting to \$217,081.86.

The work of the pay-roll division continues to be heavy, and consists of a detailed examination and verification of all pay rolls of the commission and those of the government of the Canal Zone where payments of salaries and wages are made from appropriations by Congress. The auditing of pay rolls grows more exacting as the work progresses, due to Treasury Department requirements and to the requirements of this office for a closer and more diligent check of the disbursements of funds for salaries and wages. The work of examining the pay rolls is not confined to the mathematical correctness of calculations relating to time and amounts, but consists of a careful detailed check against the personnel records of all gold employees, maintained in this office, and a verification of deductions made on account of funds due the Government for commissary and hotel coupon books, meal tickets, transportation reimbursement, lost tools and metal checks, hospital and corral bills, and other miscellaneous collections. There are 125 pay rolls each month, carrying an aggregate of about 36,000 payments and involving a disbursement of approximately \$1,500,000 monthly. After the pay rolls have been passed by this office the force engaged on that work is detailed to the various time-keeping offices of the several departments and divisions to check the time books against the pay rolls as a verification of the payments made and to see that all time is kept in accordance with the rules and regulations of the Isthmian Canal Commission.

During the year this division has passed 4,263 meritorious sick leave cases which are instances of minor injuries incurred during the performance of duty and where payment has been authorized by the chairman and chief engineer, amounting to \$49,957.80.

By your order of August 17, 1910, this office is charged with the supervision and direction of time keeping and matters related thereto, and the new compilation of time-keeping rules put into operation on September 1, 1910, has increased the work of this division of the office, but has resulted in a more uniform method among all departments and divisions of handling questions relating to time keeping, the good effect of which is manifested by the greatly improved form in which the pay rolls are submitted to this office for examination. The existing method of handling pay rolls has resulted in fewer exceptions by the accounting officials at Washington on account of pay-roll disbursements during the past fiscal year than during any prior year since the beginning of the work.

The inspection of the accounts of all bonded employees who are charged with the receipt or disbursement of public funds and the issue of coupon books and meal tickets has been continued during the year with a force of 3 inspectors where 4 have heretofore been engaged on this work. The volume of work has increased over all

prior years, there now being 140 financial accounts, 42 coupon-book accounts, and 71 meal-ticket accounts, the number of inspections and transfers of accounts made during the year aggregating 1,176. The financial accounts consist of the records of cash transactions in tax collectors' offices, post offices, clubhouses, hospitals, district physicians' offices, hotels, disbursing offices, water rents, courts, collectors of revenues, and other miscellaneous accounts where collections of Government revenues are made. These accounts are inspected at frequent but irregular periods and a uniform method of handling maintained by all fiscal officers. Monthly accounts are rendered by all financially responsible employees, the accounts being audited and balanced at the close of each monthly period. The work is important and has undoubtedly been the cause of the very small number of errors in these accounts, and practically prevents intentional misappropriation of funds by any manipulation of the accounts, the one or two small exceptions during several years being at once discovered and full restitution made the Government.

The maintenance of the records of contract laborers, which involves the keeping of accounts for transportation furnished them in order that collection may be made, has been continued. The number of impostors for contract laborers who were detected increased, and many adjustments of payments were made. The expense of this branch of the department has well paid for itself, the recoveries from impostors during the past year amounting to over \$12,000, while there is no way to estimate the saving to the commission in instances where erroneous ratings were prevented. Many contract laborers who had some amount of wages due them have left the work without fully reimbursing the Government for their transportation. These items, when the statement now in course of preparation is completed, will be applied to the uncollected transportation charges. The recently issued circular whereby a uniform rating of 20 cents per hour is fixed for European laborers who are able-bodied and not under 21 years of age will considerably reduce the work of this branch, eliminate many perplexing adjustments, and for some time remove the incentive for substitution. Toward the end of the work, however, when there is a surplus of labor, the preferred clause in the contracts will have a decided value and the records of European laborers will become of considerable importance. An individual record of a laborer and his check, such as the record kept of contract laborers, is in many cases very valuable to him, for if he fails to collect his pay for a few months after his check has been taken up and issued to some one else he has considerable difficulty in identifying himself as the rightful claimant for an unpaid amount.

The work of time inspection has increased in volume during the past year. The field covered by this work has gradually grown larger and its scope extended to cover special investigations, especially those wherein Government material or labor has been diverted. The work has also increased on account of the extension of night and Sunday work and the advancement of the work on the relocation of the Panama Railroad. On account of decreased operations at some points and increases at others, it was found necessary to make some change in the distribution of the inspectors, reducing the number of districts from five to four. To secure a compliance with circulars 299 and 229 which authorize a uniform classification of

gold and silver employees, a great deal of care and work is necessary by the inspectors in checking the ratings within all divisions, they being required to report every instance where the authorized classification and ratings are not being observed.

It requires the closest scrutiny on the part of the time inspectors to prevent or correct the improper crediting of time by foremen, especially those in charge of the lower classes of laborers, but it is believed that the frequent but irregular inspections have practically eliminated intentional wrongdoing in this respect. During the past fiscal year there has been an average of 29 men engaged on this work, excluding 5 senior inspectors located at Ancon, Culebra, Gorgona, Gatun, and Cristobal. On May 1, 1911, the senior inspectors were reduced to 4 and the districts rearranged to meet the changed conditions, locating the senior men at Ancon, Empire, Gatun, and Cristobal. The average number of inspections made daily amounts to 11,368 and in addition to this there were over 3,000 special reports necessitating investigations, most of which were settled by action of the department or division involved and without being reported to the office of the chairman and chief engineer. On account of the nature of the work and the long and irregular hours it has been found very difficult to retain the services of efficient men in this work.

The cash balance in the hands of the disbursing officer has been verified and a detailed count made on December 31, 1910, and May 31, 1911. In addition to this the transfer of cash was witnessed and verified by this office on September 1, 1910, when the disbursing officer turned over his cash to his assistant, and again verified when same was retransferred upon the return of the disbursing officer, October 30, 1910. There have also been several verifications of the cash balance and cash values in the hands of the treasurer of the Canal Zone.

Under the existing agreement with the Republic of Panama, whereby the United States is to construct and maintain water works, sewers, and pavements in the cities of Panama and Colon, there has been expended for these purposes to June 30, 1911, \$1,461,303.31 in the city of Panama and \$1,225,922.50 in the city of Colon. In accordance with the provisions of the agreement, these totals include the accrued interest at the rate of 2 per cent per annum to that date, amounting to \$101,012.78 for the work in Panama and \$65,029.55 for the work in Colon. The Republic of Panama has been credited with the sum of \$568,690.45, leaving a balance of \$2,118,535.36 to be paid as agreed. Of the amount credited, \$22,420.63 represents a credit on account of water used by the Isthmian Canal Commission in Panama and Colon; and \$546,269.82 represents the actual collections for water rentals made by the superintendent of public works and small deficits, in the amounts due quarterly, made up by the Government of Panama as a part reimbursement on account of the expenditures. The collections have been disposed of as follows: \$103,540.71 has been deposited in the Treasury as "Miscellaneous receipts"; \$441,254.32 has been repaid to appropriations for the department of construction and engineering; and the balance, \$1,474.79, collected in June, will be repaid hereafter. In formulating the new agreement the old method of calculating the payments was changed, so that the Republic of Panama now pays to the United States each year, in quarterly



installments, an amount calculated on the proportion which the current year bears to the life of the agreement. This is a more equitable arrangement for the liquidation of both principal and interest and was readily accepted by the Republic of Panama.

#### ACCOUNTS OF THE CANAL ZONE GOVERNMENT.

The duties of auditing accounts of the Canal Zone government have been executed uniformly with the methods of the past three years. The fiscal operations have increased, and the revenues for the past fiscal year have exceeded those of any prior year. Table 14, submitted herewith, shows that during the year there has been collected \$320,891.63; while the expenditures, as shown by Table 15, have decreased from \$388,572.12 during the fiscal year ended June 30, 1910, to \$180,886.96 for the past year, the principal causes of the reduction being in the construction of roads and trails and reduced operations on account of the construction of water works and sewers.

The accounts of all fiscal officers of the government of the Canal Zone, including those of the several Young Men's Christian Association clubhouses, have been audited and balanced each month. This work involved the examination of 552 monthly accounts, including those of the treasurer, collector of revenues and his deputies, circuit-court clerks and district judges, marshals, Young Men's Christian Association secretaries, and other miscellaneous accounts, their collections and balances on hand being again verified by the outside inspectors.

Table 16 shows the available balances in hands of the treasurer of the Canal Zone government at the close of business June 30, 1911, by appropriations. The recommendation of this office in the annual report for the fiscal year 1911, that existing balances for all prior years be made available until expended, was carried to the sundry civil act, approved March 4, 1911, and so authorized by Congress. As a consequence of this legislation the balances in "Public improvements and schools," 1908, 1909, 1910, and 1911, also the unexpended balances for the same years remaining in "Miscellaneous and contingent expenses," will now be carried forward without year, and thereby become available for any expenditures during the fiscal year ending June 30, 1912.

In the preceding annual report of this department attention was invited to the fact that unexpended balances were accumulating in the annual allotment of \$10,000 made by Congress to care for the miscellaneous and contingent expenses of the Canal Zone, and an amendment was recommended and so passed in the sundry civil act to set aside a "miscellaneous and contingent fund not exceeding \$10,000," so that hereafter the amount carried to this fund will be a sum equal to the amount of disbursements thereunder and leaving no unexpended balance. In both instances the amendments will be of great benefit in handling the Canal Zone revenues.

During the year there have been 495 claims against the Canal Zone government audited and settlements passed to the treasurer for payment, and on June 30 there were 44 unsettled claims in course of adjustment.

The accounts of the treasurer have been maintained in two banks at Washington, D. C., and one depository on the Isthmus. The

average monthly balance at Washington has been \$981,620.75, and that on the Isthmus \$43,239.99, from which a revenue on account of interest has been received, amounting to \$27,763.40 for the year. This is a reduction in the amount of interest earned during the preceding year, due to the failure to secure for the fiscal year 1911 a rate of interest as high as that which was obtained for 1910.

Tables 17, 18, and 19 show the fiscal transactions of the Canal Zone postal service, in which there has been a considerable increase during the fiscal year just closed. The auditing of postmasters' accounts involves the examination of 768 money-order reports and 816 reports of stamp sales. These reports show that during the year 214,501 money orders have been issued, amounting to \$5,304,900.60; and that 39,156 money orders, amounting to \$1,404,957.29, were paid or repaid during the same period.

The stamp sales throughout the Canal Zone amounted to \$82,613.72. The postal records show that during the fiscal year to June 30, 1911, there were over 35,000 money orders repaid in the Canal Zone, amounting to \$1,338,000; and on account of such deposits there has been maintained a balance of approximately \$350,000, with but little fluctuation during the past three or four years. This in a degree shows to what extent the post offices are used as savings depositories by the employees, and I desire to renew the recommendation contained in the preceding annual report of this department, wherein it is suggested that some system be installed providing depositories for the savings of employees without being charged a fee therefor, and without being carried into the regular accounts of postal operations. During the year the Canal Zone government has paid \$40,000 to the Isthmian Canal Commission as a partial reimbursement for salaries and wages of employees in the postal service which are paid from congressional appropriations.

The order of the Secretary of War, dated December 3, 1904, provides in part as follows:

The authorities of the Canal Zone shall purchase from the Republic of Panama such stamps as the authorities of the Canal Zone desire to use in the Canal Zone at 40 per cent of their face value; but this order shall be inoperative unless the proper authorities of the Republic of Panama shall by suitable arrangement with the postal authorities of the United States provide for the transportation of mail matter between post offices on the Isthmus of Panama and post offices in the United States at the same rates as are now charged for domestic postage in the United States, except all mail matter lawfully franked and inclosed in the so-called penalty envelopes of the United States Government concerning the public business of the United States, which shall be carried free, both by the Governments of Panama and of the Canal Zone.

Under the above arrangement there has been paid by the Canal Zone government to the Republic of Panama from the date of the order to June 30, 1911, \$174,850.60. Inasmuch as the ports of Balboa and Cristobal have been established by the United States Government and the present conditions are not such as existed at the time of its issue, the matter is brought to your attention with the recommendation that negotiations be entered into with a view of relieving the Canal Zone government of this obligation.

The financial accounts of the clubhouses on the Isthmus have been audited monthly and inspections made at the clubhouses at irregular periods during the year. The coupon system in use in the clubhouses for several years has been abolished, the operations now being confined to cash only and without the use of coupon books. The

cash system has been a great improvement over the coupon-book system and has resulted in a considerable reduction in the work of the employees and in the accounting. The recent authority whereby the clubhouses are granted the privilege of collecting membership dues from employees of the commission and Panama Railroad Co. by deductions on the pay rolls has been of considerable benefit in increasing their membership, and with but little additional trouble or expense. The total revenues of the clubhouses during the fiscal year just closed have amounted to \$91,723.76, while the revenues for the preceding fiscal year amounted to \$64,973.12.

#### CLAIMS FOR INJURY AND DEATH.

The work involved in the handling of claims arising under the act approved May 30, 1908, effective August 1, 1908, which is performed under the immediate supervision of the claim officer, has increased very materially each year. During the period from August 1, 1908, to June 30, 1909, 703 claims under the original act developed from the 1,490 injuries and 111 deaths that were reported. During the fiscal year ended June 30, 1910, 1,199 claims were filed out of 1,218 injuries and 81 deaths that were reported; and during the last fiscal year 1,619 claims developed from the 1,573 injuries and 112 deaths that were reported. The reason that so few claims were filed during the first year of the operation of the act as compared with the total number of injuries received was due to the fact that report was made of injuries which caused incapacity for less than 15 days and which did not permit the payment of compensation, and also to the lack of knowledge of the provisions of the law.

In addition to the cases arising under the act of May 30, 1908, cases of meritorious sick leave have been granted under the act of February 24, 1909, authorizing pay for injuries causing incapacity for 30 days or less, which in practice has been limited usually to cases of incapacity lasting 15 days or less, as follows: Five hundred and eighty-one cases during the fiscal year ended June 30, 1909, 1,342 cases during the fiscal year 1910, and 4,263 cases during the last fiscal year.

The total expenditure to June 30, 1909, was \$44,263.66, the expenditure for the fiscal year ending June 30, 1910, was \$133,873.85; and during the last fiscal year \$253,622.42 was expended.

Table 12, submitted herewith, is a statement by departments and divisions showing the number of deaths and injuries incurred by employees of the commission during the past fiscal year. Table 13 is a statement by months showing the expenditures under the acts of May 30, 1908, and February 24, 1909. The injury claims division of this office exercises no jurisdiction over applications for meritorious sick leave under the act of February 24, 1909, except to transmit to the Department of Commerce and Labor data which that department desires for its statistical reports.

Section 5 of the sundry civil appropriation act of March 4, 1911, extended the provisions of the injury compensation act to apply to all employees under the Isthmian Canal Commission who were injured or killed in the course of their employment without negligence or misconduct on their part, and provided that "claims for compensation on account of injury or death resulting from an accident occurring hereafter shall be settled by the chairman of the Isthmian Canal

Commission, who shall, as to such claims and under such regulations as he may prescribe, perform all the duties now devolving upon the Secretary of Commerce and Labor." This amendment also extended the time within which claims on account of death might be filed from three months to one year. This amendment was made in accordance with the recommendation of this department in the annual report of 1910, and its value to the beneficiaries of the injury claim laws and to the commission is plainly manifest. As a result the work of settling claims is handled more economically and settlements are made in considerably less time than was necessary under the former law and regulations, which required that the claims be submitted to the Secretary of Commerce and Labor at Washington for settlement.

The present practice is to enter on a pay roll prepared at the end of each month all claims for compensation on account of injuries which were completed during the month and in which no question as to their validity was raised. Upon this roll, the form of which was approved by the Comptroller of the Treasury, the chairman allows at one time all the claims shown thereon. All claims of beneficiaries of deceased employees and all claims for compensation on account of injuries concerning which there is any doubt as to the validity thereof are submitted to the chairman for his decision, with a brief of the facts and recommendation of this office as to the proper action to be taken. If these claims are allowed, the injury claims are carried to a first pay roll which is made up thereafter, and the claims on account of death are carried to a separate pay roll, the form of which has also received the approval of the Comptroller of the Treasury.

#### EMPLOYEES' BONDS.

The contract with the Illinois Surety Co., whereby the employees of the commission who are bonded are carried on a schedule bond, has remained in effect during the past fiscal year, and collections made from such employees for payment of the premiums. The existing schedule bond carries 350 employees, including clerks where a financial or property responsibility is involved, timekeepers, postal clerks, storekeepers, quartermasters, sanitary inspectors, coupon-book issuing clerks, etc., involving a total liability of \$528,000 and annual premiums thereon amounting to \$1,584. In view of the existing conditions and the fact that these bonds are not required by law but by regulations of the commission issued for the protection of public funds and property, I am of the opinion that payment for such premiums should be authorized by Congress and renew the recommendation contained in the report for 1910 that provision be inserted in the estimates for the fiscal year ending June 30, 1913, with this end in view.

#### PERSONNEL.

There has been a reduction of five employees in this office since the last annual report. The present authorized organization provides for 122 employees, 46 of whom are time inspectors assigned to outside work.

The total of the authorized pay roll amounts to \$194,400; the actual expenditures for salaries during the year were \$182,593.43, a difference

of \$11,806.57. The expense of the office is further decreased by the payment from the Panama Railroad Co. of \$12,000 for their proportion of the time-inspection service. It is expected that the work will permit of some further reduction in the force during the present year, which will be accomplished by leaving existing vacancies unfilled.

#### CANAL APPROPRIATIONS AND EXPENDITURES.

Attached are the usual statistical tables that have been submitted with the report of the office having jurisdiction over the general accounts of the commission. An additional table has been added, Table 1. This table shows briefly that, of the total amount appropriated for the canal, \$296,566,928.76, the amount that should be considered as having been expended or made available for expenditure to meet the actual cost of the canal, exclusive of fortifications, is \$288,012,468.30. No similar statement has ever been included in the report of the commission, and it may be criticized from a book-keeping standpoint; but the form is justified by the essential facts given.

The item of \$5,549,000.20, which is shown to have been repaid into the United States Treasury by the commission and Panama Railroad Co., includes \$406,250 of the annual subsidy paid by the company to the United States prior to June 25, 1910, the date of the approval of the act, which by section 2 released it of the requirement to pay this subsidy due to the United States as the successor to the rights of the Republic of Panama and the United States of Colombia. It also includes interest amounting to \$391,453.76 on the loans made to the Panama Railroad Co. under authority of Congress, dividends on Panama Railroad stock amounting to \$344,945, which were paid into the Treasury early in 1905, and also the sum of \$238,589.02, received almost entirely from the Panama Railroad Co. in the form of rentals on vessels and other property purchased from canal appropriations.

These items are proper deductions from the total appropriations made by Congress, even though they do not represent expenditures from appropriations for the canal returned directly to the Treasury. They may legitimately be considered as a part of the profits which the Panama Railroad has made from the sale of material and the rendition of service to the Isthmian Canal Commission. The transactions between the commission and the railroad in the beginning could have been simplified and the payments made by the commission to the railroad could have been based solely upon the actual cost to the railroad of the material furnished and service performed, just as settlements are now made for service or material furnished by one department or division of the commission to another. The fact remains that the Panama Railroad Co. did make these payments into the Treasury from its surplus accumulated out of payments made from appropriations for the canal and not expended, as would have been entirely proper, in putting its plant into proper condition, and the amount that is to be considered as the ultimate cost of the canal should be reduced accordingly.

Respectfully,

H. A. A. SMITH,  
*Examiner of Accounts.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

TABLE 1.—*Statement of moneys available for and applied to the purchase of canal rights and cost of canal construction to June 30, 1911.*

Appropriations by Congress (Table 3).....		\$206,566,928.76
Armament of fortifications.....	\$1,000,000.00	
Seacoast batteries.....	2,000,000.00	
Private acts.....	5,460.18	
Collections returned to United States Treasury as miscellaneous receipts and lost to canal appropriations (Table 4).....	5,549,000.20	
		<hr/> 8,554,460.38
Net amount available.....		288,012,468.38
Classified expenditures (Table 5).....		225,470,053.26
Unapplied credits to expenditures:		
Water rentals.....	568,690.45	
French scrap used or sold.....	1,248,881.64	
Unpaid rolls on June 30, 1911.....	1,749,937.31	
Subsidy from Panama R. R. Co.....	406,250.00	
Dividends on Panama R. R. stock.....	344,945.00	
Interest on loans to Panama R. R. Co.....	391,453.76	
Miscellaneous rentals.....	238,589.02	
		<hr/> 4,948,747.18
		220,521,306.08
Material and supplies and other unclassified items (Table 2) less \$36,668.93 for fortifications and private acts.....		7,663,750.81
Bills collectible, outstanding.....		911,367.41
Unexpended appropriation balances (Table 6) <sup>1</sup> excepting \$2,969,391.25 for fortifications.....		50,468,307.06
Collections returnable to appropriations (Table 2), \$90,069.99, less \$12,331.97 due Panama R. R. Co. for duties on scrap.....		77,738.02
		<hr/> 288,012,468.38
Total accounted for.....		

TABLE 2.—*Statement of receipts, disbursements, and balances available June 30, 1911.*

## RECEIPTS.

Appropriations by Congress (Table 3).....	\$253,526,928.76
Water rentals, Panama and Colon.....	568,690.45
Salvage of French material and equipment.....	1,248,881.64
Collections account sale of Government property, etc. (Table 4)....	5,549,000.20
Collections due individuals and companies.....	16,972.73
	<hr/> 260,910,473.78
Total receipts.....	

## DISBURSEMENTS.

Classified expenditures (Table 5).....	225,470,053.26
Department of civil administration.....	\$4,891,521.10
Department of sanitation.....	13,194,372.85
Hospitals and asylums.....	\$6,667,729.61
Sanitation.....	5,446,965.18
Construction and repair of buildings.....	1,079,688.06
Department of construction and engineering....	123,386,129.78
Atlantic division.....	33,860,373.16
Central division.....	67,938,114.79
Pacific division.....	21,587,641.83
General items.....	83,998,029.53
Paid into United States Treasury for sale of Government property, etc.....	5,549,000.20
Services rendered and material sold individuals and companies.....	4,167,762.42

<sup>1</sup> To the unexpended balances (Table 6) \$19,397,698.31 add \$43,040,000 appropriated for canal purposes and seacoast batteries but not carried on the books of the United States Treasury during the fiscal year 1911.

Unclassified expenditures.....		\$7,069,828.74
Material and supplies.....	\$6,730,693.41	
Other unclassified items.....	339,135.33	
Bills collectible outstanding.....		911,357.41
Total.....		243,168,002.03
Less amounts included in above but unpaid on June 30.....		1,749,937.31
Salaries and wages unpaid on rolls to June 1, 1911.....	217,081.88	
Pay rolls for the month of June, 1911.....	1,532,855.45	
Net disbursements.....		241,418,064.72
Balance available June 30, 1911.....		19,492,409.06
Congressional appropriations (Table 6).....	19,397,698.31	
Miscellaneous receipts of United States funds (Table 8).....	90,069.99	
Collections account of individuals and companies.....	4,640.76	
Due individuals and companies.....	\$16,972.73	
Less duty on scrap repaid appropriations and due to Panama R. R. Co.....	12,331.97	
Total.....		260,910,473.78

TABLE 3.—Statement of appropriations by Congress.

Purchase of canal rights, June 28, 1902.....		\$40,000,000.00
Purchase of Canal Zone rights, Apr. 28, 1904.....		10,000,000.00
Construction of canal:		
June 28, 1902.....		10,000,000.00
Dec. 21, 1905.....		11,000,000.00
Feb. 27, 1906.....		5,990,786.00
Construction of canal.....	\$5,340,786.00	
Reequipment of Panama R. R.....	650,000.00	
Construction of canal, June 30, 1906.....		25,456,415.08
Expenses in the United States.....	368,242.69	
Construction, engineering, and administration.....	21,018,537.24	
Civil administration.....	968,200.00	
Sanitation and hospitals.....	2,101,435.15	
Reequipment of Panama R. R.....	1,000,000.00	
Construction of canal, Mar. 4, 1907.....		27,161,367.50
Expenses in the United States.....	253,000.00	
Construction, engineering, and administration.....	20,366,000.00	
Civil administration.....	825,000.00	
Sanitation and hospitals.....	2,034,000.00	
Reequipment of Panama R. R.....	1,385,000.00	
Purchase of Panama R. R. bonds.....	2,298,367.50	
Construction of canal, Feb. 15, 1908.....		12,178,900.00
Expenses in the United States.....	18,600.00	
Construction, engineering, and administration.....	11,990,400.00	
Sanitation and hospitals.....	169,900.00	
Construction of Canal, May 27, 1908.....		29,187,000.00
Expenses in the United States.....	176,000.00	
Construction, engineering, and administration.....	26,085,000.00	
Sanitation and hospitals.....	1,575,000.00	
Civil administration.....	241,000.00	
Reequipment of Panama R. R.....	1,100,000.00	
Payment to P. B. Banton for injuries.....	10,000.00	
Construction of canal, Mar. 4, 1909.....		5,458,000.00
Construction, engineering, and administration.....	5,458,000.00	
Construction of canal, Mar. 4, 1909.....		33,638,000.00
Expenses in the United States.....	225,000.00	
Construction, engineering, and administration.....	29,368,000.00	
Civil administration.....	630,000.00	
Sanitation and hospitals.....	2,715,000.00	
Reequipment of Panama R. R.....	700,000.00	
Construction of canal, Feb. 25, 1910.....		76,000.00
Civil administration.....	76,000.00	

Construction of canal, June 25, 1910.....	\$37,855,000.00
Expenses in the United States.....	\$210,000.00
Construction, engineering, and administration..	35,300,000.00
Civil administration.....	795,000.00
Sanitation and hospitals.....	1,550,000.00
Construction of canal, Mar. 4, 1911 <sup>1</sup> .....	45,560,000.00
Expenses in the United States.....	180,000.00
Construction, engineering, and administration..	43,100,000.00
Civil administration.....	680,000.00
Sanitation and hospitals.....	1,600,000.00
Total for canal construction.....	293,561,468.58
Armament of fortifications, Mar. 4, 1911.....	1,000,000.00
Seacoast batteries, Canal Zone, Mar. 4, 1911.....	2,000,000.00
Private acts for relief.....	5,460.18
Elizabeth G. Martin, No. 97, June 17, 1910.....	1,200.00
Marcellus Troxell, No. 174, Jan. 13, 1911.....	1,500.00
W. L. Miles, No. 196, Feb. 13, 1911.....	1,704.18
Chas. A. Caswell, No. 248, Mar. 2, 1911.....	1,056.00
Total appropriations by Congress.....	296,566,928.76
Less amount not carried to the credit of Canal Commission appropriations by the United States Treasury during fiscal year 1911.....	43,040,000.00
Total credited by United States Treasury to June 30, 1911....	253,526,928.76

<sup>1</sup> The appropriations by act of March 4, 1911, were made immediately available. However, \$43,040,000 of the total amount appropriated was not carried to the credit of the Isthmian Canal Commission on the books of the United States Treasury during the fiscal year 1911.

TABLE 4.—Detailed statement of receipts for sale of property, services rendered, etc., which revert to the United States Treasury as miscellaneous receipts and are lost to canal appropriations to June 30, 1911.

	Collections.	
	Fiscal year 1911.	Total to date.
Sale of Isthmian Canal property.....		\$1,085,463.03
Sale of property.....		\$850,500.11
Sale of French material and equipment.....		81,634.80
Sale of water.....		255.43
Sale of Panama R. R. stock.....		1,300.00
Mess accounts.....		46,879.48
Receipts from pay patients.....		79,992.68
Quarantine subsistence.....		24,900.63
Rentals of Isthmian Canal property.....		521,441.02
Rent of lands and buildings.....		41,427.24
Rent of equipment.....		311,047.33
Panama water and sewer rentals.....		71,967.71
Colon water and sewer rentals.....		31,573.00
Rentals, miscellaneous.....		66,425.74
Work done by Isthmian Canal Commission.....		207,786.52
Labor furnished Panama R. R. Co.....		180,336.97
Other labor furnished.....		27,449.55
Miscellaneous.....		2,983,114.63
Telegraph and telephone service.....		3,547.35
Hotels and boarding camps.....		758,470.34
Hotel coupon books.....		32,238.28
Laundry receipts.....		7,382.01
Corral receipts.....		8,628.56
Miscellaneous.....	\$50.00	93,679.41
Interest on loans.....	79,900.63	391,453.76
Repayment of loans.....	100,000.00	1,687,714.92
Subsidies and dividends.....		751,195.00
Annual subsidy from Panama R. R. Co.....		406,250.00
Dividends on Panama R. R. stock.....		344,945.00
Total.....		5,549,000.20



TABLE 5.—Detailed statement of classified expenditures for the fiscal year ending June 30, 1911, and total from beginning of the work to date.

	Fiscal year 1911.	Total to June 30, 1911.
<b>Department of civil administration:</b>		
Administration.....	\$59,194.23	\$477,471.98
Supreme and circuit courts.....	31,451.56	297,915.84
Prosecuting attorney.....	12,318.89	39,558.47
Division of revenues.....	14,320.80	145,696.80
Division of posts.....	74,400.09	558,020.75
Division of customs.....	8,893.77	57,196.78
Division of lands and buildings.....	7,240.55	102,046.07
Division of estates.....	1,320.07	24,112.28
Police and prisons.....	315,792.83	1,678,991.70
Fire protection.....	109,491.42	554,326.22
Maintenance and operation, waterworks and sewers—		
Panama.....	12,586.76	119,482.27
Colon.....	16,816.22	165,373.04
Repairs and maintenance of pavements—		
Panama.....	5,612.11	16,472.50
Colon.....	6,779.79	28,888.48
Miscellaneous Zone public works.....	4,355.03	23,225.44
Treasurer of the Canal Zone.....	9,689.48	28,933.87
Construction of buildings.....	4,421.36	506,649.74
Repairs to buildings.....	4,695.21	11,399.22
Survey of Canal Zone lands.....	55,850.16	55,850.16
<b>Total, department of civil administration.....</b>	<b>755,070.44</b>	<b>4,901,521.10</b>
<b>Department of sanitation:</b>		
Administration.....	88,745.52	689,073.16
Hospitals and asylums—		
Medical storehouse, Colon.....	10,078.76	22,208.81
Ancon hospital.....	432,980.50	2,865,237.76
Colon hospital.....	204,006.26	1,522,645.50
Taboga sanitarium.....	30,771.24	66,467.38
Santo Tomas hospital.....	9,725.26	49,690.65
Other hospitals, dispensaries and sick camps.....	218,186.32	1,691,085.74
Quarantine.....	42,185.60	289,104.91
Sanitation—Panama and Colon—		
Sanitation proper, Panama.....	44,902.19	730,294.65
Disposal of garbage, street cleaning, etc., Panama.....	10,859.19	59,746.71
Sanitation proper, Colon.....	22,940.55	553,883.39
Disposal of garbage, street cleaning, etc., Colon.....	17,323.42	28,574.77
Zone sanitation—		
Sanitation proper.....	438,046.51	3,235,016.55
Disposal of garbage, street cleaning, etc.....	109,322.16	330,309.81
Construction of buildings.....	14,420.59	1,625,452.02
Repairs to buildings.....	22,090.45	54,226.04
<b>Total, department of sanitation.....</b>	<b>1,717,792.62</b>	<b>13,194,872.85</b>
<b>Department of construction and engineering:</b>		
<b>Atlantic division—</b>		
Dry excavation (prism)—		
Construction work.....	191,232.16	1,198,502.30
Plant.....	184,707.19	15,847.61
Dredging excavation (prism)—		
Construction work.....	1,418,158.88	5,647,574.78
Plant.....	1,998,728.68	662,600.98
Gatun dam and spillway—		
Construction work.....	2,702,288.09	7,829,895.08
Plant.....	67,225.42	869,352.17
Gatun locks—		
Construction work.....	7,974,666.82	15,140,498.42
Plant.....	1,497,468.89	714,237.44
Gatun power plant (permanent)—construction work.....	1,194,462.86	
Rock and sand account—		
Porto Bello rock (plant).....	1,849,459.00	498,846.65
Nombre de Dios sand (plant).....	1,182,396.48	143,132.04
Transportation (plant).....	1,537,321.96	698,663.36
Colon breakwater—		
Construction work.....	609,261.79	696,832.65
Plant.....	218,251.80	697,431.21
Gatun-Mindí levee.....	14,563.74	72,468.47
<b>Total, Atlantic division.....</b>	<b>11,185,217.35</b>	<b>38,899,873.16</b>
<b>Central division—</b>		
Dry excavation—		
Construction work.....	11,738,586.48	66,992,606.52
Plant.....	2,080,161.44	781,411.02
Dredging excavation—construction work.....		9,798.40
Clearing channel in Gatun Lake.....	4,489.17	139,316.41

1 Credit.

TABLE 5.—Detailed statement of classified expenditures for the fiscal year ending June 30, 1911, and total from beginning of the work to date—Continued.

	Fiscal year 1911.	Total to June 30, 1911.
Department of construction and engineering—Continued.		
Central division—Continued.		
Masonry—		
Construction work.....	\$6,224.44	\$6,224.44
Plant.....	8,758.00	8,758.00
Total, central division.....	9,607,866.65	67,938,114.79
Pacific division—		
Dry excavation (prism)—		
Construction work.....	151,011.38	262,161.93
Plant.....	38,938.23	318,046.45
Dredging excavation (prism)—		
Construction work.....	1,663,961.39	7,176,057.43
Plant.....	1,294,739.99	401,145.32
Pedro Miguel locks and dams—		
Construction work.....	3,078,385.70	5,705,641.04
Plant.....	1,837,186.24	282,047.16
Miraflores locks and dams—		
Construction work.....	2,630,516.26	5,519,890.26
Plant.....	106,631.95	792,703.60
Rock and sand account—		
Ancon rock plant.....	1,209,285.87	440,112.99
Chamé sand plant.....	1,116,897.45	137,899.12
Miraflores power plant—construction work.....	1,92,356.35	393,840.47
Naos Island breakwater—construction work.....	21,238.30	58,106.06
Total, Pacific division.....	6,580,317.31	21,587,641.83
General items:		
Hotels, messes, and kitchens—operations.....	1,83,927.52	1,83,927.52
Tivoli Hotel.....	1,26,425.05	1,26,425.05
Hotels, messes, and kitchens—alterations and improvements.....	5,283.36	5,283.36
Lands purchased—		
For construction work or to be flooded.....	83,550.00	336,352.70
For other purposes.....	4,000.00	77,210.35
Cristobal terminals—		
Docks and wharves.....	1,3,129.08	289,546.26
Dredging.....	68,773.26	79,191.06
Balboa terminals—docks and wharves.....	15,590.28	906,711.44
Panama R. R. second main track.....	21,885.58	1,123,477.93
Relocation of Panama R. R.—		
Construction work.....	1,736,405.61	6,586,647.22
Maintenance.....	8,368.31	29,071.45
Plant.....	87,326.42	419,531.44
Purchase, improvement, and repair of steamers—		
Panama.....	18,149.56	655,942.48
Colon.....	21,669.50	579,812.22
Cristobal.....	55,852.94	713,335.43
Ancon.....	58,347.91	725,521.88
Construction of buildings, department of construction and engineering.....	77,798.00	9,581,006.16
Alteration and repair of buildings, department of construction and engineering.....	154,158.16	423,682.03
Purchase from New Panama Canal Co.....		40,000,000.00
Payment to Republic of Panama.....		10,000,000.00
Loans to Panama R. R. Co.....	1,100,000.00	3,247,332.11
Purchase of Panama R. R. stock.....		157,118.24
Construction, waterworks and sewers—		
Panama.....	1,297,667.48	654,888.73
Colon.....	1,148,639.57	583,265.49
Zone waterworks and sewers—		
Construction.....	709,029.57	3,858,907.43
Repairs and maintenance.....	340,497.32	615,811.62
Paving—		
Panama.....	25,128.18	566,958.18
Colon.....	68,954.31	381,039.77
Zone roadways—		
Construction.....	14,852.12	1,409,257.10
Repairs and maintenance.....	49,639.15	110,888.41
Miscellaneous grading and other municipal work.....	708.98	4,128.27
Moving and care of French material and equipment.....	57.63	2,833.23
Plant in Panama R. R. service.....	6,025.26	593,562.22
Permanent plant.....	24,593.01	24,593.01
Lighting and buoying the canal.....	14,374.88	14,374.88
Total, general items.....	3,112,334.60	83,998,029.53
Grand total.....	33,048,607.97	225,470,053.26

1 Credit.

TABLE 6.—Statement of receipts and disbursements from appropriations for fiscal year ending June 30, 1911.

	Balance brought forward July 1, 1910.	Appropriation June 28, 1910, available July 1, 1910.	Private acts.	Collections repaid to appropriations.	Appropriation Mar. 4, 1911, immediately available.	Total available during year.	Disbursements.	Available balance June 30, 1911.
<b>In the United States:</b>								
Salaries.....	\$33,078.59	\$140,000.00		\$2,229.30		\$175,407.89	\$149,028.48	\$26,379.41
Incidentals.....	14,929.55	70,000.00		832.52		85,762.37	56,565.38	29,196.99
Construction and engineering:								
Officers and employees.....	1,246,883.70	3,900,000.00		75,128.41		5,225,010.11	4,527,492.74	697,517.37
Skilled and unskilled labor.....	2,346,773.28	13,500,000.00		145,896.74		15,992,670.02	13,336,835.59	2,655,834.43
Material and supplies.....	1,067,983.23	15,000,000.00		2,712,738.63		18,779,721.86	12,856,423.51	5,923,298.35
Incidental expenses.....	22,566.33	900,000.00		15,060.44	\$660,000.00	1,587,631.77	1,003,026.26	584,605.51
Civil administration:								
Officers and employees.....	48,331.48	600,000.00		110,000.00		758,331.48	586,858.45	171,523.03
Skilled and unskilled labor.....	31,854.97	20,000.00		446.18	20,000.00	71,854.97	41,057.36	30,797.61
Material and expenses.....	172,411.76	100,000.00				272,860.94	200,496.25	72,364.69
Sanitation:								
Officers and employees.....	239,888.88	600,000.00		4,824.33	600,000.00	1,444,713.21	775,058.28	669,654.93
Skilled and unskilled labor.....	429,324.40	200,000.00		8,384.68	200,000.00	857,909.08	618,127.15	239,781.93
Material and expenses.....	285,813.03	780,000.00		90,132.21		1,105,945.24	922,267.06	183,678.18
Reequipment Panama R. R.....	2,045,170.47					2,045,170.47		2,045,170.47
Relocation Panama R. R.....	2,117,773	2,000,000.00		108.18	2,750,000.00	4,732,222.91	1,810,300.96	2,921,921.95
Canal connecting Atlantic and Pacific Oceans.....	1,915,408.08			402.69		1,915,810.74	413,433.33	1,502,377.41
Sanitation in cities of Panama and Colon.....	800,000.00					800,000.00	468,034.44	331,965.56
Survey of Canal Zone lands.....		75,000.00				75,000.00	32,222.76	42,777.24
Relief of—								
Elizabeth G. Martin, June 17, 1910.....			\$1,200.00			1,200.00	1,200.00	
Marcellus Troxell, Jan. 13, 1911.....			1,500.00			1,500.00	1,500.00	
W. L. Mues, Feb. 13, 1911.....			1,704.18			1,704.18	1,704.18	
Chas. A. Caswell, Mar. 2, 1911.....			1,068.00			1,068.00	1,068.00	
Armament of fortifications.....					1,000,000.00	1,000,000.00	30,668.73	969,331.25
<b>Total.....</b>	10,681,194.75	37,855,000.00	5,460.18	3,166,322.31	5,520,000.00	57,227,977.24	37,830,278.93	19,397,698.31

<sup>1</sup> \$35,000 of this balance will be transferred in July, 1911, to "Miscellaneous material purchases" appropriation by the United States Treasury.

Note.—For detail of collections repaid to appropriations see Table 7. The act of Mar. 4, 1911, made immediately available appropriations totaling \$48,560,000. Of this total, \$5,620,000 were carried on the books of the United States Treasury to the credit of canal appropriations before the close of the fiscal year 1911, and \$43,040,000 during the fiscal year 1912.

TABLE 7.—*Detailed statement of amounts returnable to the appropriations collected during the fiscal year ending June 30, 1911.*

Nature of collections.	From employees (act of Mar. 4, 1907).	From other sources (act of June 25, 1910). <sup>1</sup>	From other departments of the Govern- ment.	From over- payments and miscel- laneous items.	Total.
Sale of property.....	\$18,281.34	\$509,638.41	\$12,512.57	\$2,441.23	\$542,873.55
Rent of equipment.....		42,728.64			42,728.64
Panama water rents.....		78,571.94			78,571.94
Colon water rents.....		71,592.50			71,592.50
Rentals, miscellaneous.....		49,180.55	3,107.04		52,287.59
Labor furnished Panama R. R.		191,729.94			191,729.94
Other labor furnished.....	1,937.49	79,812.89	113,361.96	1,612.11	196,524.45
Sale of hotel books.....		118,065.62			118,065.62
Hotel and boarding camp re- ceipts.....	1,269,755.73	60,394.30	779.70		1,330,929.73
Hospital receipts.....	92,295.46	73,524.42			165,819.88
Laundry receipts.....	8,367.72	4,486.30			12,854.02
Quarantine receipts.....	411.27	15,323.77			15,735.04
Corral receipts.....	18,768.82	47,620.92	437.80		66,827.54
Telegraph and telephone re- ceipts.....	173.75	169.94		34.78	378.47
Transportation.....	4,331.14		10,490.43	11.60	14,833.17
Electric-light receipts.....	46.38	64,367.85	4,934.65		69,348.88
Sales of scrap.....		213,528.50			213,528.50
Duties on scrap.....		19,790.59			19,790.59
Miscellaneous.....	30.00	1,380.40		63.15	1,473.55
Overpayments and correc- tions.....				4,961.79	4,961.79
Total.....	\$1,414,399.10	1,642,087.75	145,624.15	9,124.66	3,211,235.66

<sup>1</sup> Detailed statement of collections as required by sec. 4, act of June 25, 1910.<sup>2</sup> This amount is made up of collections on pay rolls amounting to \$1,191,215.81 (Table 8) plus \$223,183.39 cash collections from employees.TABLE 8.—*Detailed statement of collections repaid to appropriations during the fiscal year ending June 30, 1911, and balance of fiscal year collections returnable to appropriations but not repaid during the year.*

Nature of collections.	From employees (act of Mar. 4, 1907).	From other sources (act of June 25, 1910).	From other depart- ments of the Govern- ment.	From over- pay- ments and miscel- laneous items.	Total repayments.	Balance of collections, fiscal year 1911, re- turnable but not repaid.
Sale of property.....	\$18,281.34	\$510,273.42	\$12,512.57	\$2,441.23	\$543,508.56	\$23,385.17
Rent of equipment.....		42,728.64			42,728.64	
Panama water rents.....		78,067.65			78,067.65	267.29
Colon water rents.....		70,922.00			70,922.00	1,107.60
Rentals, miscellaneous.....		45,230.45	3,107.04		48,337.49	3,930.10
Labor furnished Panama R. R.....		174,338.32			174,338.32	17,776.60
Other labor furnished.....	1,937.49	36,206.10	113,361.96	1,612.11	153,119.66	8,704.79
Sale of hotel books.....		147,267.26			147,267.26	12,425.40
Hotel and boarding camp receipts.....	1,269,755.73	55,465.82	779.70		1,326,001.25	5,236.26
Hospital receipts.....	92,295.46	66,092.92			158,388.38	10,182.45
Laundry receipts.....	8,367.72	3,990.22			12,357.94	498.08
Quarantine receipts.....	411.27	14,954.25			15,365.52	1,077.35
Corral receipts.....	18,768.82	49,511.60	437.80		68,718.22	2,579.07
Telegraph and telephone receipts.....	173.75	1,297.29		34.78	1,505.82	9.45
Transportation.....	4,331.14	3,515.84	10,490.43	11.60	18,349.01	
Electric-light receipts.....	46.38	61,596.58	4,934.65		66,577.61	2,792.27
Sales of scrap.....		213,528.50			213,528.50	
Duties on scrap.....		20,805.14			20,805.14	
Miscellaneous.....	30.00	1,380.40		63.15	1,473.55	
Overpayments and correc- tions.....				4,961.79	4,961.79	
Total.....	1,414,399.10	1,597,174.40	145,624.15	9,124.66	3,166,322.31	190,089.99

<sup>1</sup> See Table 2.

TABLE 9.—Statement of collections made on pay rolls of the Isthmian Canal Commission during the fiscal year ending June 30, 1911, as authorized by section 8 of the act of Mar. 4, 1907.

Month.	Total.	Commissary coupon books.	Hotel coupon books.	Subsistence.	Lost metal checks.	Transportation.	Medical service.	Bills collectible.	Miscellaneous.
GOLD ROLLS.									
1910—July.....	\$156,296.27	\$102,718.12	\$49,333.38	.....	\$77.50	.....	\$2,623.29	\$150.81	\$1,443.16
August.....	158,059.75	101,889.64	50,076.68	.....	29.00	.....	2,192.84	143.40	3,728.10
September.....	151,791.48	105,988.59	50,449.55	.....	29.50	.....	2,517.86	106.25	2,566.33
October.....	162,977.26	105,099.58	52,775.48	\$13.40	26.50	\$30.00	2,426.07	263.73	2,357.70
November.....	164,906.74	106,316.50	53,096.76	28.20	33.50	.....	2,660.24	115.51	2,683.03
December.....	171,897.24	111,754.44	53,958.20	1.20	25.00	.....	2,145.52	236.78	3,775.57
1911—January.....	183,211.15	121,749.17	53,498.77	1.73	30.50	120.00	2,595.01	552.48	4,155.14
February.....	176,133.50	111,649.70	56,771.17	08	21.00	.....	2,703.80	578.37	4,192.43
March.....	165,401.98	107,024.17	50,642.75	1.45	33.50	167.00	2,741.46	595.65	3,976.44
April.....	199,949.68	111,393.33	50,617.20	.....	25.50	.....	2,695.15	419.94	3,509.78
May.....	173,899.79	115,274.59	52,008.44	11.99	28.00	32.00	2,011.48	283.87	4,090.52
June.....	138,979.74	94,291.67	38,230.20	.....	32.00	40.00	.....	.....	.....
Total.....	1,983,064.48	1,295,149.51	611,368.58	58.75	341.50	399.00	30,012.62	3,790.71	41,963.81
SILVER ROLLS.									
1910—July.....	171,320.48	123,382.74	75.00	45,925.96	288.50	500.40	419.34	13.80	684.74
August.....	171,046.03	122,406.70	84.60	47,071.52	281.50	465.58	480.72	23.50	252.41
September.....	174,796.02	126,927.15	49.80	46,290.07	290.00	404.34	474.31	20.20	340.15
October.....	177,168.44	129,625.12	19.80	45,975.37	300.00	355.66	473.84	26.40	432.28
November.....	181,224.42	132,337.00	64.80	47,138.29	304.50	278.12	558.71	26.77	497.23
December.....	176,424.55	131,266.05	30.00	45,632.02	256.80	127.80	628.44	6.50	476.24
1911—January.....	198,400.42	146,605.77	94.80	44,949.29	300.00	196.70	472.63	7.20	772.08
February.....	170,767.99	128,615.00	94.80	39,752.23	298.43	196.43	566.11	20.33	1,185.77
March.....	165,617.99	126,844.95	66.60	36,777.43	262.50	102.61	487.82	36.04	1,587.04
April.....	173,476.31	132,761.97	84.60	38,466.99	260.50	123.01	538.70	21.35	1,190.19
May.....	175,620.24	138,666.18	66.60	35,536.28	275.17	96.60	383.17	.....	720.24
June.....	161,219.11	125,663.33	79.80	33,968.58	286.33	514.66	504.82	3.84	558.76
Total.....	2,092,062.40	1,565,151.96	782.40	504,484.03	3,403.50	3,438.90	5,998.61	203.95	8,599.06
Grand total of collections.....	4,075,146.88	2,860,301.47	.....	.....	.....	.....	.....	.....	60,532.86
Collected for Panama R. R. Co. and various individuals.....	2,883,831.07	2,800,301.47	.....	.....	.....	.....	.....	.....	23,629.60
Returnable to appropriations (Table 8).....	1,191,215.81	.....	612,150.98	504,542.78	3,745.00	3,847.90	36,011.23	3,994.66	26,923.26

TABLE 10.—Statement of hotel coupons and meal tickets honored during the fiscal year ending June 30, 1911.

	Kitchens.			Messes.			Hotels.		
	30-cent tickets.	Value.	13-cent tickets.	Value.	30-cent tickets.	Value.	40-cent tickets.	Value.	30-cent coupons.
July.....	38,561	\$11,568.30			207	\$62.10	96,820	\$38,328.00	184,113
August.....	37,216	11,164.80			289	86.70	96,114	38,045.60	183,065
September.....	34,595	10,378.50			165	49.50	95,382	38,152.80	179,783
October.....	34,964	10,489.20			232	69.60	99,299	39,719.80	194,636
November.....	34,616	10,384.80			196	58.50	91,339	36,535.60	191,276
December.....	33,326	9,997.80			133	39.90	88,086	35,238.40	196,306
January.....	32,676	9,802.80			109	32.70	88,794	35,517.60	204,277
February.....	27,319	8,195.70	300	\$40.00	133	39.90	77,394	30,857.60	185,771
March.....	27,633	8,285.90	426	56.80	135	40.50	82,962	33,180.80	199,170
April.....	1 27,977	7,553.79	378	50.40	1 120	32.40	76,928	30,771.20	182,470
May.....	1 28,940	7,813.80	312	41.60	1 219	59.13	73,964	29,581.60	179,210
June.....	1 29,931	8,081.37	135	18.00	1 337	90.99	71,743	28,867.20	167,498
Total.....	387,774	113,728.76	1,551	206.80	2,274	661.92	1,036,815	414,726.00	2,247,565
									674,269.50

1 27-cent tickets.

TABLE 11.—Statement of Isthmian Canal Commission bills registered for collection during the fiscal year ending June 30, 1911.

Months.		Number of bills.	Amount.
1910.			
July		304	\$118,207.18
August		334	108,302.69
September		303	46,393.14
October		529	160,878.68
November		357	71,068.44
December		429	191,413.40
1911.			
January		339	143,093.98
February		425	136,147.41
March		374	232,187.60
April		580	260,607.11
May		420	126,031.08
June		364	122,837.11
Total		4,708	1,710,068.62

TABLE 12.—Statement of injuries sustained by employees of the Isthmian Canal Commission, July 1, 1910, to June 30, 1911, for which compensation was due or claimed, under the acts of Congress of May 30, 1908, and February 24, 1909.

	Department or division.										
	Atlantic.	Central.	Pacific.	Quartermaster.	Mechanical.	Sanitary.	Civil administration.	Subsistence.	Chief engineer.	Examiner of accounts.	Totals.
Injuries reported.....	602	433	265	76	154	24	8	2	8	1	1,673
Claims for injuries:											
Filed.....	597	425	258	73	153	20	8	2	7	1	1,544
Approved.....	449	299	170	48	117	9	6		3	1	1,102
Disapproved.....	21	27	10	8	5	3			2		76
Accidental deaths reported.....	54	33	17		4	1	3				112
Claims on account of death:											
Filed.....	35	27	6		4		3				75
Approved.....	20	14	6		3		3				46
Disapproved.....	2	6									8
Other claims for 15 days or less.....	1,265	1,317	551	223	845	7	15	1	7	2	4,263
Total accidents reported.....	1,951	1,783	833	299	1,003	32	26	3	15	3	5,948

Injury claims pending with the Department of Commerce and Labor, 11.

Death claims pending with the Department of Commerce and Labor, 2.

Average duration of disability of cases for which claims have been filed, 51 days.

All other cases, less than 15 days, estimated duration, 54 days.

Principal reasons assigned for disapproval of injury claims: Not sufficient evidence of connection between injury and incapacity not injured in the course of employment, and negligence or misconduct on the part of injured employee.

Principal reasons assigned for disapproval of death claims: Negligence or misconduct on the part of deceased employee and not injured in the course of employment.

TABLE 13.—*Statement of amounts paid, under act of May 30, 1908, to employees as compensation and on account of death of employees injured in course of employment, July 1, 1910, to June 30, 1911; and amounts paid, under act of Feb. 24, 1909, for injuries lasting 15 days or less.*

Department or division	July.	August.	September.	October.	November.	December.	January.	February.
<b>Atlantic:</b>								
Injuries.....	\$5,769.63	\$4,288.18	\$4,520.92	\$6,008.85	\$5,120.60	\$4,269.17	\$5,295.09	\$4,258.47
Deaths.....	1,467.53	916.03	1,025.90	1,173.93	1,262.81	2,017.88	1,264.04	1,982.35
<b>Central:</b>								
Injuries.....	3,133.86	2,601.22	3,380.32	4,454.59	5,471.16	3,614.41	2,077.18	3,414.16
Deaths.....	435.46	629.95	416.73	852.09	508.62	819.51	781.13	446.48
<b>Pacific:</b>								
Injuries.....	1,234.93	1,326.56	1,954.61	2,432.85	1,882.69	1,882.69	933.91	2,661.96
Deaths.....	661.42	538.80	568.80	150.00	427.74	358.28	429.42	277.65
<b>Mechanical:</b>								
Injuries.....	999.39	1,282.56	1,308.02	761.75	1,806.42	1,484.50	3,051.79	1,282.19
Deaths.....	66.56	368.16	204.32	158.32	135.20	135.20	135.20	140.40
<b>Quartermaster:</b>								
Injuries.....	148.70	54.55	322.70	421.07	367.88	220.80	92.75	571.22
Deaths.....								
<b>Sanitary:</b>								
Injuries.....								
Deaths.....								
<b>Civil administration:</b>								
Injuries.....				64.50				
Deaths.....								
<b>Chief engineer:</b>								
Injuries.....								
Deaths.....								
<b>Examiner of accounts:</b>								
Injuries.....	295.83		86.25		363.75			217.50
Deaths.....								
<b>Subsistence:</b>								
Injuries.....				61.88				
Deaths.....								
<b>Purchasing department, Washington:</b>								
Injuries.....		225.60						
Deaths.....								
<b>Total.....</b>	<b>14,218.81</b>	<b>12,231.01</b>	<b>13,788.57</b>	<b>16,534.83</b>	<b>17,348.87</b>	<b>14,802.44</b>	<b>14,061.11</b>	<b>15,242.38</b>

Department or division	March.	April.	May.	June.	Total injury payments.	Total death payments.	Total under act Feb. 24, 1909.	Grand total.
<b>Atlantic:</b>								
Injuries.....	\$5,118.50	\$6,396.45	\$6,811.15	\$10,416.44	\$68,259.05		\$14,567.28	\$101,455.34
Deaths.....	3,187.09	1,399.88	1,336.12	1,605.45		\$18,629.01		
<b>Central:</b>								
Injuries.....	2,238.88	4,043.93	2,800.52	7,831.41	45,061.64		15,338.27	68,607.19
Deaths.....	938.20	753.06	964.66	669.77		8,207.28		
<b>Pacific:</b>								
Injuries.....	1,662.15	3,486.62	1,680.73	3,834.31	24,964.01		6,464.71	36,572.62
Deaths.....	583.91	714.96	207.00	205.92		5,143.90		
<b>Mechanical:</b>								
Injuries.....	2,406.12	2,488.06	1,084.92	4,861.88	22,609.60		11,647.16	36,970.16
Deaths.....	260.00	277.68	226.44	605.92		2,713.40		
<b>Quartermaster:</b>								
Injuries.....	89.09	1,144.39	220.62	554.17	4,207.94		1,580.19	5,933.93
Deaths.....	76.50	24.30	21.60	23.40		145.80		
<b>Sanitary:</b>								
Injuries.....		35.60	72.95	67.67	176.22		22.60	198.82
Deaths.....								
<b>Civil administration:</b>								
Injuries.....	297.67	619.50	255.75	469.09	1,706.51		240.29	2,355.80
Deaths.....		159.00	45.00	205.00		409.00		
<b>Chief engineer:</b>								
Injuries.....		28.60		152.45	181.05		55.72	236.77
Deaths.....								
<b>Examiner of accounts:</b>								
Injuries.....					963.33		14.58	977.91
Deaths.....								
<b>Subsistence:</b>								
Injuries.....					61.88		27.00	88.88
Deaths.....								
<b>Purchasing department, Washington:</b>								
Injuries.....					225.00			225.00
Deaths.....								
<b>Total.....</b>	<b>16,858.11</b>	<b>21,552.65</b>	<b>15,727.46</b>	<b>31,293.88</b>	<b>168,416.22</b>	<b>35,248.39</b>	<b>49,957.80</b>	<b>253,622.42</b>

Total payments to June 30, 1911: Injuries, \$297,562.27; deaths, \$59,984.40; under act of Feb. 24, 1909, \$74,193.26; grand total, \$431,739.93.



TABLE 14.—*Receipts and expenditures, Canal Zone funds, from July 1, 1910, to June 30, 1911.*

## REVENUES COLLECTED.

[This statement includes balances in hands of collecting officers, but does not include money orders, Y. M. C. A., nor trust funds.]

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
Aerated waters.....	\$850.00	\$2,190.40	\$1,778.40	\$1,390.00	\$6,208.80
Animal license.....	53.40	229.60	191.70	111.00	585.70
Auctioneers.....		4.00	2.00	21.00	27.00
Bowling alleys.....		15.00			15.00
Building rentals.....	2,123.26	1,758.00	600.00		4,481.26
Burial permits.....	453.12	453.12	453.13	453.13	1,812.50
Cabs and coaches.....		70.50	8.25	6.50	85.25
Carts.....	134.40	577.30	133.10	1,344.00	2,188.80
Circuit court collections.....	1,750.84	1,750.84	1,750.36	1,750.36	7,001.40
Dance halls.....	20.00	70.00	20.00	50.00	160.00
Distilling licenses.....	309.88		2,124.32	110.78	2,544.98
District court collections.....	6,834.30	5,249.15	4,274.49	6,091.25	22,449.19
Escheated estates.....	389.56	389.57	389.57	389.57	1,558.27
Gathering coconuts.....				108.75	108.75
Hucksters.....				90.80	90.80
Hunting permits.....	491.25	491.25	491.25	491.25	1,965.00
Insurance taxes.....	128.15	128.15	128.15	128.14	512.59
Interest.....	6,940.85	6,940.85	6,940.85	6,940.85	27,763.40
Land rentals.....	3,142.63	7,359.79	6,753.18	1,865.20	19,120.80
Market rentals.....	414.60	2,904.78	1,103.20	614.00	5,036.58
Marshals' fees.....	424.49	424.48	424.48	424.49	1,697.94
Merchandise and drugs.....	1,064.20	4,025.20	2,986.60	2,019.20	10,095.20
Motor vehicle licenses.....	264.50	264.50	264.50	264.50	1,058.00
Peddling.....	1,339.00	3,163.50	1,510.00	2,872.50	8,885.00
Physicians' licenses.....	23.75	23.75	23.75	23.75	95.00
Police fines.....	83.23	83.23	83.23	83.23	332.92
Poll taxes.....	174.00	502.00	118.00	375.00	1,169.00
Pound fees.....	39.15	240.80	99.80	151.65	531.40
Public entertainments.....	27.00	322.00	83.10	87.00	519.10
Real estate taxes.....	4,014.30	15,326.67	10,989.90	10,802.74	41,133.61
Restaurants.....	194.80	514.80	311.80	159.80	1,181.20
Retail liquor licenses.....		50,400.00	27,600.00	19,200.00	97,200.00
Retail sale of tobacco.....	909.60	3,282.80	2,318.40	1,963.20	8,474.00
Sale imported meats.....	160.90	39.79	2.10	113.12	315.91
Sale impounded animals.....	.40	14.00		10.00	24.40
Sale property.....	3,003.10	2,503.10	3.10	3.10	5,512.40
School tuition, lost or damaged books.....	193.57	193.57	193.57	193.57	774.28
Services district prisoners.....	6.40				6.40
Slaughter taxes.....	102.00	13,781.00	3,371.50	380.00	17,634.50
Water taxes.....	1,360.35	8,187.85	4,391.55	6,591.95	20,531.70
Total.....	37,420.48	133,874.84	81,920.33	67,675.96	320,891.63
Sale of postage stamps.....					82,613.72
Money-order fees.....					23,457.98
Total.....					426,963.33

TABLE 14.—*Receipts and expenditures, Canal Zone funds, from July 1, 1910, to June 30, 1911—Continued.*

## EXPENDITURES.

[This statement includes all outstanding audited claims, but does not include expenditures of money orders, Y. M. C. A., nor trust funds.]

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
<i>Public improvements.</i>					
Roads and trails:					
Construction.....	\$24,260.26	<sup>1</sup> \$86.07	\$5,863.98	\$4,541.37	\$34,588.54
Maintenance.....	1,078.11	7,045.47	475.63	6,703.31	15,302.52
Market houses:					
Construction.....		110.64			110.64
Maintenance.....	24.43	303.58	147.94	56.94	532.89
Operation.....	384.00	411.00	432.90	382.56	1,610.46
Slaughterhouses:					
Construction.....		776.88			776.88
Maintenance.....		379.83	14.10		393.93
Operation.....	375.00	375.00	375.00	375.00	1,500.00
Waterworks and sewers:					
Construction.....	121.80	605.30	59.16	1,417.48	2,203.54
Maintenance.....	7.50	388.24	113.13	173.99	682.86
Street lighting.....	79.02	321.72	460.23	174.65	1,035.62
Maintenance miscellaneous public works..	30.00	298.00	2.27		330.27
<i>Public schools.</i>					
Schoolhouses:					
Construction.....	4,268.54	3,713.32	135.72	4,965.28	13,062.86
Maintenance.....	646.06	578.05	253.33	828.12	2,305.56
Salaries—Superintendent, teachers, and clerks.....	13,957.02	13,957.07	13,957.06	13,957.04	55,828.19
Janitor service.....	310.95	665.35	409.18	545.28	1,930.76
Furniture and equipment.....	321.37	516.22	161.44	536.23	1,535.26
Supplies.....	1,428.55	1,612.40	1,466.50	1,582.83	6,090.28
Traveling and miscellaneous expenses.....	899.15	555.03	42.06	701.31	2,197.55
<i>Maintenance administrative districts.</i>					
Salaries tax collectors.....	1,009.58	1,009.57	1,009.59	1,009.58	4,038.32
Salaries district judges.....	4,384.55	4,384.54	4,384.53	4,384.54	17,538.16
Supplies and miscellaneous.....	177.82	410.60	312.01	127.47	1,027.90
Zone charity cases, maintenance.....	900.00	900.00	900.00	900.00	3,600.00
District prisoners, maintenance.....	2,901.54	2,806.33	4,015.13	1,868.32	11,591.32
Total.....	57,564.05	42,048.07	34,990.89	45,231.30	179,834.31
<i>Contingent expenses.</i>					
Gratuity penitentiary prisoners.....					667.50
Miscellaneous.....					385.15
<i>Postal service.</i>					
Purchase of stamps.....					28,075.60
Transportation of mails:					
Isthmus.....					12,760.00
Ocean.....					10,782.56
Miscellaneous expenses.....					7,506.03
Transfer to Isthmian Canal Commission as reimbursement in part for salaries paid.....					40,000.00
Total.....					280,013.15

<sup>1</sup> Credit for work done for Las Cascadas estates.

TABLE 15.—*Statement of balances in treasury, by appropriations, June 30, 1911.*

Public improvements and schools.....	\$43.27
Fiscal year 1908.....	4,448.73
Fiscal year 1909.....	15.75
Fiscal year 1910.....	24,731.53
Fiscal year 1911.....	127,029.55
Miscellaneous and contingent.....	743.25
Fiscal year 1908.....	3,780.15
Fiscal year 1909.....	1,181.70
Fiscal year 1910.....	7,913.36
Fiscal year 1911.....	9,062.65
Postal service:	
Fiscal year 1910.....	7,676.22
Fiscal year 1911.....	10,561.43
Money-order funds.....	798,878.31
Young Men's Christian Association funds.....	19,112.03
Trust funds.....	13,250.23
Invalidated money orders.....	1,840.59
Total.....	1,080,283.75

TABLE 16.—Statement showing total value of money orders issued, money orders paid, money orders outstanding, and balance of money-order funds June 30, 1911.

## POSTAL SERVICE.

Years ending June 30—	Money orders issued.				Total.
	United States.	Canal Zone.	Martinique.	Costa Rica.	
1907.....	\$2,057,358.87	\$301,672.62	.....	.....	\$2,359,031.49
1908.....	3,460,755.25	1,225,929.73	.....	.....	4,686,684.98
1909.....	3,783,090.44	1,383,659.02	.....	.....	5,166,749.46
1910.....	3,976,883.08	1,247,610.22	\$4,060.30	.....	5,228,553.60
1911.....	4,014,819.20	1,283,403.12	6,239.78	\$444.50	5,304,906.60
Total.....	17,302,906.84	5,442,274.71	10,300.08	444.50	22,755,926.13

Years ending June 30—	Money orders paid by—				Total.
	United States.	Canal Zone.	Martinique.	Costa Rica.	
1907.....	\$1,581,251.91	\$208,165.48	.....	.....	\$1,789,417.39
1908.....	2,875,719.61	1,017,750.97	.....	.....	3,893,470.58
1909.....	3,583,419.57	1,492,144.76	.....	.....	5,075,564.33
1910.....	4,068,650.46	1,331,568.20	\$2,267.60	.....	5,402,486.26
1911.....	3,725,996.12	1,337,915.09	6,022.08	.....	5,069,933.29
Total.....	15,835,037.67	5,367,644.50	8,289.68	.....	21,210,971.85

## SUMMARY.

<b>Total money orders drawn:</b>		
On the United States.....	\$17,302,906.84	
On the Canal Zone.....	5,442,274.71	
On Martinique.....	10,300.08	
On Costa Rica.....	444.50	
		\$22,755,926.13
<b>Total money orders paid:</b>		
By the United States.....	15,835,037.67	
By the Canal Zone.....	5,367,644.50	
By Martinique.....	8,289.68	
<b>Total outstanding:</b>		
Drawn on the United States.....	1,172,088.86	
Drawn on the Canal Zone.....	350,658.02	
Drawn on Martinique.....	1,863.40	
Drawn on Costa Rica.....	444.50	
		22,755,926.13
<b>Money-order funds remitted to United States.....</b>		16,299,349.17
<b>United States orders paid in the Canal Zone.....</b>		231,489.92
<b>Money-order funds remitted to Martinique.....</b>		7,987.74
<b>Martinique orders paid in the Canal Zone.....</b>		345.62
		16,539,072.45
<b>Money orders drawn on and paid in United States.....</b>		15,835,037.67
<b>Money orders drawn on and paid in Martinique.....</b>		8,289.68
<b>Funds in hands of Postmaster General, United States.....</b>		695,701.72
<b>Due from Martinique post office department.....</b>		43.08
		16,539,072.45

## MONEY ORDERS OUTSTANDING.

Drawn on the United States.....	1,172,088.86
Drawn on the Canal Zone.....	350,658.02
Drawn on Martinique.....	1,863.40
Drawn on Costa Rica.....	444.50
	1,525,054.58

## MONEY-ORDER FUNDS.

Cash in hand, Canal Zone treasurer.....	798,876.31
Cash in hands of postmasters.....	28,580.26
Due from United States Post Office Department.....	695,701.72
Due from Martinique post office department.....	43.08
Cash in hands of Canal Zone treasurer, account invalid orders.....	1,849.09
	1,525,054.58

TABLE 17.—Statement of money-order business and stamp sales, fiscal year ended June 30, 1911.

Post offices.	Amount Issued.	Drawn on—				Money orders paid and repaid in Canal Zone post offices.					Postal receipts.	
		United States.	Canal Zone.	Martinique.	Costa Rica.	United States or- ders paid.	Canal Zone on United States, repaid.	Martinique.		Canal Zone orders paid.	Money- order fees.	Stamp sales.
								Paid.	Repaid.			
Ancon.....	\$492, 276. 20	\$420, 028. 36	\$71, 211. 34	\$980. 50	\$96. 00	\$13, 898. 18	\$4, 140. 10	\$194. 18	\$5. 00	\$108, 823. 11	\$2, 384. 93	\$11, 999. 00
Baños.....	236, 901. 94	159, 516. 41	77, 225. 53	160. 00		1, 659. 48	2, 699. 73			70, 335. 20	1, 000. 27	1, 5. 95
Bas Obispo.....	192, 374. 73	70, 378. 34	31, 912. 39	89. 00		1, 014. 16	2, 664. 78			28, 778. 14	468. 48	3, 920. 00
Corozal.....	149, 944. 77	99, 024. 40	44, 858. 87		61. 50	741. 46	2, 031. 20			40, 500. 10	600. 59	1, 397. 00
Cristóbal.....	1, 077, 848. 83	934, 017. 10	143, 512. 23	270. 50	49. 00	16, 898. 08	13, 993. 76	43. 68		235, 145. 34	4, 670. 26	19, 441. 00
Culebra.....	340, 897. 23	256, 668. 39	83, 628. 84	600. 09		4, 828. 66	3, 913. 02	10. 67	5. 00	71, 841. 63	1, 553. 14	6, 010. 00
Empire.....	407, 891. 82	331, 871. 56	74, 782. 66	1, 219. 60	18. 00	6, 812. 31	3, 457. 19		3. 00	77, 316. 88	1, 970. 66	7, 905. 00
Gatun.....	705, 045. 99	521, 648. 05	183, 139. 84	193. 60	65. 00	7, 738. 86	6, 564. 17	97. 09	2. 00	146, 399. 93	3, 172. 63	11, 900. 00
Gorgona.....	592, 891. 32	430, 119. 19	161, 343. 63	1, 380. 50	50. 00	5, 159. 97	7, 599. 87		5. 00	136, 360. 36	2, 465. 64	6, 265. 00
Las Cascaidas.....	280, 533. 26	204, 234. 42	76, 116. 84	182. 00		2, 497. 53	4, 925. 91			67, 887. 29	1, 162. 50	2, 515. 00
Matachin.....	50, 684. 56	35, 696. 65	14, 995. 91	22. 00		731. 34	437. 35			12, 605. 28	298. 77	1, 220. 00
Miraflores.....	100, 651. 96	51, 352. 56	49, 181. 39	38. 00	110. 00	362. 02	314. 81			39, 284. 48	452. 41	1, 270. 00
Paraiso.....	175, 144. 40	116, 945. 67	58, 104. 73	94. 00		1, 060. 86	4, 995. 18			44, 342. 01	788. 57	2, 005. 00
Pedro Miguel.....	421, 849. 66	277, 453. 60	143, 555. 88	820. 18	20. 09	2, 594. 50	3, 461. 66		20. 00	126, 919. 76	1, 713. 54	3, 098. 00
San Pablo.....	75, 237. 86	39, 874. 83	35, 188. 53	174. 50		294. 89	699. 20			29, 520. 27	326. 77	975. 00
Tabarilla.....	100, 702. 08	65, 994. 67	34, 676. 41	16. 00	15. 00	553. 49	2, 941. 73			39, 704. 53	488. 88	1, 361. 00
Tabo.....												388. 21
District quartermaster, Mount Hope.....											\$2. 94	231. 00
Invalidated.....										7, 094. 00		
Total.....	5, 304, 906. 60	4, 014, 819. 20	1, 283, 403. 12	6, 239. 78	444. 50	66, 606. 58	96, 068. 78	345. 62	40. 00	1, 271, 808. 31	23, 457. 98	82, 613. 72

1 Newspaper postage.

2 Exchange on draft to Martinique.

TABLE 18.—Statement showing the monthly money-order business of the Canal Zone postal service, fiscal year ended June 30, 1911.

Months.	Drawn on—				Fees.	Canal Zone orders paid in—				Cash remittances to United States Post Office Department.
	Orders issued.					Canal Zone orders paid in—				
	United States.	Canal Zone.	Martinique.	Costa Rica.		United States.	Martinique.	United States.		
1910.										
July.....	\$443,164.44	\$1,936.03	\$335,843.40	\$546.00						
August.....	424,465.86	1,836.25	324,925.11	402.50						
September.....	466,127.28	2,025.55	354,692.30	601.00						
October.....	429,211.70	1,962.05	320,697.13	361.88						
November.....	434,905.55	1,938.85	337,127.27	548.00						
December.....	473,032.41	2,201.91	372,049.57	470.50						
1911.										
January.....	413,994.14	1,828.06	308,894.55	468.50						
February.....	445,188.72	1,946.29	340,013.03	588.50						
March.....	408,991.18	2,188.90	306,546.23	943.50						
April.....	450,472.57	1,976.82	335,854.11	565.70						
May.....	390,330.30	1,757.63	292,031.59	355.70						
June.....	438,054.55	1,966.70	323,144.91	388.00						
Total.....	5,304,906.60	23,455.04	4,014,819.20	6,239.78						
Total.....										
444.50										

Months.	Money orders paid and repaid in the Canal Zone.				Canal Zone orders paid in—				Cash remittances to United States Post Office Department.
	United States orders paid.	Canal Zone on United States, repaid.	Martinique.		Issued in Canal Zone, paid in Canal Zone.	Canal Zone orders paid in—			
			Paid.	Repaid.		Martinique.	United States.		
1910.									
July.....	\$4,304.10	\$7,185.70			\$118,102.38			\$734,802.23	\$275,000.00
August.....	4,961.96	5,003.32			104,155.95	\$2,098.20		310,578.13	667,639.64
September.....	6,697.52	7,067.51			122,358.94			358,358.53	275,000.00
October.....	5,177.05	7,348.22			94,157.32			131,373.99	355,000.00
November.....	4,114.10	4,416.46			90,275.20			446,460.61	769,698.53
December.....	6,646.16	7,304.83			114,677.47	2,198.38		302,195.08	305,000.00
1911.									
January.....	4,167.48	4,716.89			78,565.72			333,199.82	325,000.00
February.....	4,023.82	2,888.78			88,223.66			332,081.51	290,000.00
March.....	6,451.17	5,823.66			116,539.44	1,754.50		459,298.73	300,000.00
April.....	9,074.13	5,938.70			107,297.03			317,747.79	280,000.00
May.....	6,180.68	3,739.51			110,368.41			335,000.00	335,000.00
June.....	4,868.47	4,653.22			127,198.79				285,000.00
Total.....	66,606.60	66,066.78	345.62	40.00	1,271,806.31	6,022.08		3,725,996.12	4,422,249.17

## APPENDIX M.

### REPORT OF EDWARD J. WILLIAMS, DISBURSING OFFICER.

ISTHMIAN CANAL COMMISSION,  
DISBURSING DEPARTMENT,  
*Empire, Canal Zone, July 24, 1911.*

SIR: I have the honor to submit the following report of the disbursing department on the Isthmus for the fiscal year ended June 30, 1911:

Through the efficiency of the automatic cashiers placed on the pay car last year for expediting payment of fractional parts of a dollar, I was enabled to reduce the pay-car schedule from four days to three days in April of this year.

The Panama currency has been of sufficient volume during the past year to care for the labor payments, while it has only been necessary to bring down from the United States \$500,000 in \$20 gold pieces and \$10,000 in United States 50-cent pieces, in order to keep enough United States currency on the Isthmus for our needs.

Herewith please find statement No. 1, showing by months and grand totals for the fiscal year, amounts actually paid out: On gold rolls \$9,219,254.22, silver rolls \$10,196,732.80, public bills and reimbursement vouchers \$10,017,600.13, a grand total of \$29,433,587.15. The total number of payments on the gold pay rolls was 65,864 and on the silver rolls 392,020, or a total number of employees paid compensation during that time of 457,884.

Statement No. 2, gives the number and value of hotel books, commissary books, and meal tickets issued from this office to the various departments, by months, for the fiscal year, of a total valuation of \$4,150,943.50.

Respectfully,

EDWARD J. WILLIAMS,  
*Disbursing Officer.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

STATEMENT 1.—*Payments made by the disbursing department on the Isthmus during the fiscal year 1911.*

Months.	Gold rolls.	Silver rolls.	Public bills and reimbursement vouchers.	Total.	Items on roll each month.		
					Gold.	Silver.	Total.
1910.							
July.....	\$743, 073. 23	\$866, 507. 77	\$892, 921. 91	\$2, 502, 502. 91	5, 307	34, 458	39, 765
August.....	777, 282. 74	869, 394. 21	958, 371. 71	2, 599, 949. 66	5, 360	34, 306	39, 666
September.....	732, 829. 77	869, 216. 91	693, 038. 97	2, 325, 085. 65	5, 236	33, 988	39, 224
October.....	763, 566. 08	868, 279. 77	979, 603. 79	2, 611, 449. 64	5, 582	33, 872	39, 454
November.....	765, 992. 44	877, 891. 47	784, 065. 07	2, 427, 948. 98	5, 427	30, 218	38, 645
December.....	786, 081. 47	837, 634. 36	771, 860. 82	2, 395, 676. 65	5, 493	32, 796	37, 889
1911.							
January.....	777, 143. 16	899, 185. 43	485, 618. 22	2, 052, 341. 80	5, 422	31, 603	37, 025
February.....	804, 979. 11	852, 740. 78	984, 472. 82	2, 642, 192. 71	5, 471	32, 095	37, 566
March.....	775, 835. 14	796, 060. 50	895, 239. 30	2, 467, 184. 94	5, 686	31, 213	36, 899
April.....	796, 926. 03	833, 370. 90	846, 406. 64	2, 525, 703. 57	5, 863	31, 488	37, 351
May.....	741, 005. 21	796, 715. 75	858, 646. 27	2, 396, 367. 23	5, 556	31, 834	37, 390
June.....	755, 489. 85	819, 733. 96	921, 956. 61	2, 497, 183. 41	5, 461	31, 549	37, 010
Total.....	9, 219, 254. 22	10, 196, 782. 80	10, 017, 600. 13	29, 433, 587. 15	66, 894	392, 020	457, 894

In addition to above, \$1,389,554.06, miscellaneous collections, was deposited with the Assistant Treasurer of the United States, New York.

STATEMENT 2.—*Coupon books and meal tickets issued by the disbursing department on the Isthmus, fiscal year 1911.*

Months.	Commissary books.			Hotel books.		Meal tickets.			
	\$2.50	\$5	\$15	\$4.80	\$15	27 cents.	30 cents.	40 cents.	No name.
<b>1910.</b>									
July.....	6, 935	21, 760	5, 410	335	2, 655	40, 200	71, 000	.....	.....
August.....	9, 345	25, 268	7, 465	665	4, 585	35, 200	104, 400	.....	160
September.....	7, 800	25, 700	5, 990	411	3, 200	23, 800	82, 000	.....	.....
October.....	7, 366	24, 768	6, 555	241	4, 050	89, 900	114, 000	.....	.....
November.....	7, 065	24, 025	6, 205	285	4, 495	31, 700	95, 000	.....	.....
December.....	8, 680	26, 160	7, 470	440	3, 795	26, 100	88, 500	.....	.....
<b>1911.</b>									
January.....	8, 900	28, 845	8, 085	719	3, 645	47, 800	112, 800	.....	.....
February.....	7, 350	20, 550	6, 200	535	4, 780	29, 800	70, 500	.....	.....
March.....	8, 225	23, 680	5, 885	104	3, 220	12, 800	56, 800	.....	500
April.....	7, 830	25, 140	7, 265	389	4, 680	43, 300	95, 000	.....	8, 700
May.....	6, 840	23, 390	6, 165	665	4, 585	31, 000	69, 400	.....	.....
June.....	7, 240	26, 015	6, 530	145	2, 625	26, 500	68, 300	.....	.....
Total.....	93, 705	295, 145	79, 865	4, 975	46, 255	103, 800	287, 100	1, 087, 800	9, 300
Value.....	234, 262. 50	1, 475, 725. 00	1, 197, 975. 00	23, 890. 00	693, 825. 00	29, 026. 00	86, 130. 00	411, 120. 00	.....
Total value.	\$2, 907, 962. 50			\$717, 706. 00				\$525, 276. 00	

Making a grand total value of \$4,150,943.50.

## APPENDIX N.

### REPORT OF HON. M. H. THATCHER, MEMBER OF ISTHMIAN CANAL COMMISSION, HEAD OF THE DEPARTMENT OF CIVIL ADMINISTRATION.

ISTHMIAN CANAL COMMISSION,  
DEPARTMENT OF CIVIL ADMINISTRATION,  
*Ancon, Canal Zone, August 1, 1911.*

SIR: I have the honor to submit the report of the department of civil administration of the commission for the fiscal year ended June 30, 1911. The organization of the department remains substantially as described in the last annual report.

#### LEGISLATION.

Congressional legislation enacted during the period of this report consisted of: (1) The act of March 4, 1911, making appropriations for the fiscal year ending June 30, 1912, and providing among other things that the act of May 30, 1908, respecting compensation for injured employees shall extend to all employees of the commission; and (2) the act approved June 25, 1910, "To further regulate interstate and foreign commerce by prohibiting transportation therein for immoral purposes of women and girls, and for other purposes." This latter act, although approved during the period of the last annual report, was not received on the Isthmus until September 23, 1910.

Fifteen Executive orders of the President and Secretary of War, having the effect of law in the Canal Zone, have been issued during the year. Among the most important orders of the President are the following: The order of July 25, 1910, authorizing the Isthmian Canal Commission to establish rules and regulations to facilitate and protect canal work; the order of July 28, 1910, prescribing the jurisdiction of Canal Zone courts in civil cases where both defendant and plaintiff are nonresidents of the Canal Zone; the order of August 20, 1910, respecting the conveyance of real estate by married women; the order of October 4, 1910, abolishing the position of tax collector, creating the position of deputy collector of revenues, and amending the tax laws; the order of February 2, 1911, providing a method of executing and recording deeds, and repealing the Executive order dated March 12, 1907, on that subject; the order of May 2, 1911, providing for the punishment of persons who return to the Isthmus after having been convicted and sentenced to imprisonment in the Canal Zone and thereafter deported; the order of May 6, 1911, respecting the arrest and discharge of deserting seamen; the order of May 11, 1911, providing for the punishment of persons riding on railway trains in the Canal Zone without the consent of those in charge of the trains; and the order of May 13, 1911, providing for the collection of a distillation tax in the Canal Zone.



During the fiscal year just ended eight ordinances have been enacted by the Isthmian Canal Commission and approved by the Secretary of War, under the provisions of section 7 of the Executive order of the President, dated March 13, 1907. The more important of these ordinances are: An ordinance providing for the licensing and regulation of motor vehicles in the Canal Zone, enacted by the Isthmian Canal Commission on August 25, 1910, and approved by the Acting Secretary of War on October 31, 1910; an ordinance providing for the fixing of rates of charges to be made for the transportation of passengers over the streets and roads of the Canal Zone, enacted by the Isthmian Canal Commission on August 25, 1910, and approved by the Secretary of War on December 3, 1910; an ordinance providing for the licensing and regulation of bicycles in the Canal Zone, enacted by the Isthmian Canal Commission on April 15, 1911, and approved by the Secretary of War on April 26, 1911; an ordinance providing for the licensing of chauffeurs for automobiles, enacted by the Isthmian Canal Commission on April 15, 1911, and approved by the Secretary of War on April 26, 1911; and an ordinance prohibiting hunting and other trespassing upon reservoirs and watersheds of the Canal Zone, enacted by the Isthmian Canal Commission on April 15, 1911, and approved by the Secretary of War on April 26, 1911.

#### RELATIONS WITH PANAMA.

Negotiations by correspondence or personal conference between the secretary of foreign affairs of the Republic of Panama and the head of the department of civil administration included, among others, the following subjects in addition to routine matters:

Charging of consular fees by consuls of the Republic of Panama for the certification of documents covering shipments consigned to the Isthmian Canal Commission and the Panama Railroad Co.; the collection of consular fees by consuls of the Republic of Panama in the United States for the certification of documents covering shipments made to merchants in the Canal Zone and the cities of Panama and Colon; the purchase of supplies from commissaries by employees of the Government of Panama and members of the diplomatic and consular corps accredited to the Republic; importation and release from the payment of customs duties of goods consigned to the Isthmian Canal Commission, Panama Railroad Co., the post exchange of the United States Marine Corps at Camp Elliott, the Young Men's Christian Association, and employees of the commission and the railroad company; the transfer by the Panama Railroad Co. to the Panaman Government of certain lots in exchange for land situated opposite the Hotel Tivoli; arrest of Americans in Zone territory by police officers of the Republic of Panama; the enforcement in the Canal Zone of the provisions of the exclusion law of the Republic of Panama; amendments of the rates, rules, and regulations governing the use of water and sewers in the cities of Panama and Colon; withdrawal from entry by the Republic of Panama of lands situated in the Republic which will ultimately be covered by the waters of Gatun Lake; the conveyance in certain cases of American citizens in the city of Panama in need of medical attention to the Ancon Hospital for treatment; the revision of the contracts between the Republic of

Panama and the Isthmian Canal Commission for the amortization of the cost of the waterworks, sewer system, and paving in the cities of Panama and Colon; the arrest, by Panaman police officers in the city of Panama of employees of the commission while engaged in sanitary and public works; the extradition of persons charged with crime; the infringement in the Canal Zone of trade-marks registered in Panama; violation and enforcement of sanitary regulations and immigration laws; validity of marriages performed by Protestant ministers in the Republic of Panama and the Canal Zone; the survey and demarcation of the permanent boundaries of the Canal Zone; arrest by police officers of the Republic of Panama of commission employees shipwrecked at Colon; fire protection in the cities of Panama and Colon; the execution of letters rogatory; construction of roads in the Canal Zone and continuation thereof in the Republic of Panama; the enforcement of laws prohibiting the recruiting of labor on the Isthmus; the collection of a license tax for the operation of motor vehicles over the streets and roads of the Canal Zone; the adoption of uniform coach rates for the Canal Zone and the cities of Panama and Colon; the prosecution of residents of the Republic of Panama implicated in the theft of property of the Isthmian Canal Commission; the purchase from commission employees by merchants of the cities of Panama and Colon of goods secured at the Isthmian Canal Commission commissaries; the adoption of uniform laws providing for the collection of distillation taxes in the Republic of Panama and the Canal Zone and governing navigation of the waters of the Republic and the Zone, and other matters; the appointment of a public administrator in the Republic to whom may be paid moneys due the estates of deceased employees of the commission who at the time of their death were citizens of the Republic of Panama; public improvements in the cities of Panama and Colon, the opening of new streets, and installation of water and sewer mains therein; the suppression of white-slave traffic through Panaman ports and in the cities of Panama and Colon; the suppression of gambling in said cities, and the promulgation of laws, resolutions, and decrees by the Panaman Government in aid of the suppression of the white-slave traffic and gambling.

The correspondence conducted with members of the diplomatic and consular corps accredited to the Republic of Panama, whose jurisdiction extends to the Canal Zone, related largely to advice of appointments and recognition by the Republic of Panama; the furnishing of transportation over the Panama Railroad; questions affecting the rights of aliens employed or residing in the Canal Zone; and with the consular representatives of Nicaragua respecting the collection by the Panama Railroad Co. from the Government of Nicaragua of wharfage and light dues accrued against the Nicaraguan vessel *Ometepe*.

The relations of the commission and the Canal Zone government with Panama and with foreign representatives continue satisfactory.

#### EXECUTIVE OFFICE.

The organization of the office of the head of the department of civil administration consists of 1 chief clerk, 1 assistant chief clerk, 18 clerks, 1 storekeeper, 1 translator, and 2 messengers.

## STEAMBOAT-INSPECTION SERVICE.

The organization of the board of local inspectors remains as described in the last annual report. During the year the board issued 56 licenses to pilots, 17 to masters—4 of which were issued as joint master-pilot licenses—12 to mates, and 11 to engineers, a total of 96 licenses. The board also made numerous investigations and inquiries respecting accidents to craft navigating the waters of the Canal Zone and the charges of improper conduct on the part of persons to whom it had issued licenses. Under the authority of the order of the President dated July 25, 1910, there were drafted by the board and adopted by the Isthmian Canal Commission on December 5, 1910, and approved by the Secretary of War on December 21, 1910, rules for the navigation of the Panama Canal and all waters under the jurisdiction of the Isthmian Canal Commission. One conviction has been secured for the violation of these rules.

By the chairman's circular No. 371, dated January 28, 1911, approved by the Secretary of War, the duties of the board were extended to include the general inspection of all floating plant of the Isthmian Canal Commission and the Panama Railroad. The licensing of chauffeurs for automobiles by the board of local inspectors is provided for by the ordinance enacted by the Isthmian Canal Commission on April 15, 1911, and approved by the Secretary of War on April 26, 1911. No licenses were issued, however, during the period covered by this report on account of delay occasioned in securing license badges.

## DIVISION OF POSTS, CUSTOMS, AND REVENUES.

This division includes the postal, customs, and public-land services, the collection of taxes and license fees, and the administration of estates of deceased American employees of the commission and the Panama Railroad Co. The organization of this division consists of 1 collector of revenues, 4 deputy collectors of revenues, 8 inspectors, 15 clerks, 2 messengers, 21 postmasters, 6 assistant postmasters, 28 postal clerks, 19 post-office messengers, 1 inspector of post offices, and 5 railway-mail messengers.

## POSTAL SERVICE.

During the year for which this report is submitted the sale of postage stamps and postal cards amounted to \$82,865.21, and \$28.51 was collected for second-class matter; a total income from postage sales of \$82,893.72, as compared with a total of \$83,847.10 for the preceding fiscal year, a decrease of \$953.38.

At Cristobal during the year there were 1,173 dispatches of mail. In the same period 141,225 registered letters and parcels were handled. Of this number 23,435 were domestic letters, 5,119 domestic parcels, 40,477 foreign letters, 1,177 foreign parcels, 68,945 official letters and parcels registered free, and 2,031 letters and parcels re-registered free. It will be noted that of the registered matter approximately 48 per cent was official.

In the post offices at Cristobal and Ancon, in which are handled foreign registered mail, 84,515 pieces were handled. Of these 8,716 pieces passed through the Ancon post office for Panama and Central and South American points, and 75,799 through the Cristobal post office

for points in the United States, the West Indies, and Europe. Sixty-six thousand six hundred and eighty-one pouches, sacks, and registered sacks were handled by the railway-mail messengers during the year.

Two hundred and fourteen thousand seven hundred and eighty money orders were issued during the year for a total of \$5,304,906.60, and the fees aggregated \$23,455.09. The number and amount of money orders sold during the past year exceed the sales during the year ended June 30, 1910, by 7,560 and \$76,344.45, respectively. The average amount of each order was \$24.69, as compared with \$25.23 for the previous year. There were paid and repaid during the year orders amounting to \$1,397,119.96. Of the money orders sold during the year orders amounting to \$4,014,819.20 were payable in the United States and foreign countries, except Martinique and Costa Rica, where \$6,239.78 and \$444.50, respectively, were payable, and orders amounting to \$1,283,403.12 in the Canal Zone.

A convention providing for the direct exchange of money orders between the Canal Zone and the Republic of Costa Rica was concluded, which became effective April 1, 1911.

There were in the post offices of the Canal Zone on June 30, 1911, unpaid money orders aggregating \$332,141.60 drawn to the order of the remitter and payable at the office of issue. The amount of these orders indicates the extent to which the post offices are used as depositories by employees.

The business transacted in the various branches of the postal division constitutes the source of a large amount of general correspondence, which is conducted in the office of the director of posts, such as correspondence relating to lost and invalidated money orders, issuance of duplicates, and the return to countries of origin of unclaimed ordinary matter, of which there were 40,373 pieces, 9,289 being domestic letters and parcels, and 31,084 foreign letters and parcels. One thousand eight hundred and thirteen misdirected domestic letters were advertised in the Canal Record, of which about 60 per cent were delivered or forwarded to addressees.

Effective January 9, 1911, a post office, officially designated as Station B, Cristobal, was established at Toro Point in a building constructed for that purpose at a cost of \$650.

An agreement was entered into between the postal systems of the Canal Zone and the United States for the reciprocal payment of indemnity for the value, up to \$25, for the loss or rifling of domestic registered matter of the third and fourth classes, and up to \$50 for domestic registered matter of the first class, to become effective July 1, 1911. The Canal Zone postal service has also been authorized to pay an indemnity of 50 francs, regardless of value, for the loss of registered articles exchanged between the Canal Zone and Postal Union countries.

#### CUSTOMS SERVICE.

During the year 264 vessels entered the port of Ancon, with a total tonnage of 457,746, and 263 vessels cleared, having a tonnage of 454,572. At Cristobal 263 vessels entered, with a tonnage of 722,870, and 264 vessels cleared, with a tonnage of 727,955.

The usual customs services, such as shipping and discharging seamen, the noting of protests, filing of manifests, etc., were rendered sea-

men and vessels. Under the agreement with Panama no duties, tolls, or customs fees were collected.

The laws of the Republic of Panama prohibiting the immigration of Chinese, Syrians, and Turks, extended to the Canal Zone by the order of the President dated January 9, 1908, were enforced.

At the port of Ancon there arrived 188 aliens whose entry was prohibited under the exclusion laws, in transit to the Republic of Panama or other countries. Of this number 98 were permitted to disembark, by authority of the Secretary of Foreign Affairs of the Republic of Panama, and 90 were either transferred to other vessels or returned to the port of embarkation.

#### LANDS AND BUILDINGS.

Under the order of the President dated January 19, 1911, the leasing of public lands was transferred to the land office created by that order under the jurisdiction of the department of law; but the approval of leases must be made by the head of the department of civil administration, as provided for in the Executive order of October 7, 1910. The collection of land rentals remains with the department of civil administration, as described in previous annual reports.

At the close of business on June 30, 1911, there were in force 2,251 leases, of which 984 were for building lots and 1,261 for agricultural lands, a decrease of 530 in the number of leases as compared with June 30, 1910, due largely to the cancellation, effective December 31, 1910, and April 1, 1911, respectively, of all leases in the Miraflores and Gatun Lake areas. The area of agricultural land under lease is 1,430 hectares, or approximately 3,534 acres. Rents collected during the year amounted to \$23,469.22, as compared with \$27,282.29 for the year ended June 30, 1910. The total collections from this source for the previous fiscal years were, in 1909, \$26,969.88, and in 1908, \$17,436.76.

I do not know what policy may be ultimately adopted by Congress and the President in regard to the disposition of the public lands of the Canal Zone—those owned by the United States Government and its corporate agent, the Panama Railroad Co.—whether these lands will be altogether withheld from settlement and preserved as military reservations, or whether they will, subject to canal and military needs, be thrown to settlement and a stable civil population invited thereon. If the latter course should be determined on, then I believe that these lands, subject to the requirements of the United States Government for any purpose, should be erected by appropriate law into homestead areas, with the right of acquisition given, under appropriate regulations, only to citizens of the United States and with preference accorded to American employees who have at any time been engaged in the various branches of the Canal Zone work; such employees who have the longest periods of service to their credit or who have sustained personal injuries in line of duty to have precedence in the matter of entries; such entries to be free, and the entries of non-employees (to begin after a reasonable period is allowed employees to take up the lands) to be at a charge sufficiently low to encourage American investment and settlement. Bona fide residence in the Zone and cultivation of the lands homesteaded for a reasonable period should be made conditions on which perfection of title should rest; a fair area should be awarded to each entryman, say not exceed-

ing 225 acres, and the law should stipulate that subsequent conveyances of these lands could only be made to Americans upon approval of the proper Government agency or official. If a civil population should be deemed desirable, I believe that a policy of the character just outlined will do more to open up and render valuable the jungles of the Zone than any other that might be projected; and a civil population thus secured and maintained would, because of its loyal and sympathetic interest, be of both moral and police value to the interests of the United States Government and the canal. Moreover, these lands and their improvements, because of their resulting value, would yield substantial taxes for local needs.

#### TAXES AND LICENSE FEES.

During the year a total of \$123,876 was collected on account of general taxes and licenses, as compared with \$107,642.58 during the year ended June 30, 1910. There was collected as distillation taxes \$2,353.88, as compared with \$3,158.67 for the fiscal year ended June 30, 1910, and \$2,209 during the year 1909. Fifty-seven licenses were issued for the sale of liquor at retail. The total collections from this source were \$68,400, as compared with \$65,400 for the previous fiscal year. The sum of \$512.59 was collected during the year in license fees from insurance companies doing business in the Canal Zone. Under the provisions of the ordinance providing for the licensing and regulation of motor vehicles in the Canal Zone 38 licenses were issued and the total of \$1,057 was collected in license fees. This amount includes the \$1 paid by each licensee for a metal tag bearing the license number.

Under the President's order of May 13, 1911, a change is made in the amount and the method of collecting the distillation tax. The order, however, did not become effective during the present fiscal year. Ordinances providing for the licensing of chauffeurs for automobiles and the licensing and regulation of bicycles were enacted by the Isthmian Canal Commission on April 15, 1911, and approved by the Secretary of War on April 26, 1911. Under the provisions of these ordinances, the amount of \$1 is to be collected for each license issued and badge furnished, but, owing to the delay in the receipt of badges and license tags, no licenses were issued during the period covered by this report.

The Executive order of October 4, 1910, making certain changes in the organization of the administrative districts of the Canal Zone, more clearly defines the laws respecting the collection of real estate taxes and also contains a provision permitting the Canal Zone government to acquire property sold for taxes.

#### ADMINISTRATION OF ESTATES.

The collector of revenues, as ex officio administrator of estates, settled 43 estates of American employees of the commission and Panama Railroad, and there were 8 estates in course of settlement on June 30, 1911. The money handled during the year on account of administration of estates aggregated \$4,748.46.

Under the provisions of sections 779 and 780 of the Code of Civil Procedure, eight estates were during the year escheated to the government of the Canal Zone on petition of the collector of revenues; the value of these estates was \$1,603.77.

## MISCELLANEOUS COLLECTIONS.

In addition to the collection of Zone revenues, this division collects for other departments of the commission various bills against employees and others on account of hospital fees, quarantine charges, sales of material, etc. These collections during the year aggregated \$21,496.87.

The revenues collected by the division during the year aggregated \$326,391.49, and the total of all moneys handled was \$5,652,727.22.

## DIVISION OF POLICE AND PRISONS.

The organization of the division of police and prisons remains as described in previous reports. On June 30, 1911, the force consisted of a chief and assistant chief, 5 clerks, 2 inspectors, 4 lieutenants, 8 sergeants, 20 corporals, 117 first-class white police officers, and 116 colored policemen. During the year all promotions above the grade of first-class policeman have been made only after examination of candidates suggested by district commanders, before a board of examination.

Two colored policemen lost their lives in the fiscal year; one being accidentally drowned and the other being accidentally shot.

Five thousand nine hundred and fifty-nine arrests were made during the year, 5,500 of which were males and 459 females, as compared with 6,407 males and 477 females, or a total of 6,947, for the previous year, representing a decrease of over 14 per cent from the previous year. The number of arrests for the year covered by this report was approximately 6 per 1,000 of population, as against approximately 9 per 1,000 for the three preceeding years, and 10 per 1,000 for the years 1905, 1906, and 1907. The months of April, May, and June, 1911, showed a decrease of about 25 per cent in the number of arrests, as compared with the corresponding period of last year. Of the total number of persons arrested, 4,764, or 80 per cent, were convicted.

There were 10 homicides, and for these 6 persons (in 5 of the cases) were convicted, all receiving penitentiary sentences of from 6 months to 15 years, and 3 defendants escaped before arrest and have never been apprehended, although suitable rewards have been offered and every effort made to locate and apprehend them. Two other defendants are now awaiting trial. No capital punishment was administered.

The rules and regulations for the government of the Canal Zone police force were revised during the year.

A substation was established at New Gatun, which is a considerable distance from the police station at Gatun, in order to provide for the detention of persons arrested there. The substation at Cerro was discontinued and the building moved to Golden Green. The cell space in the Ancon police station was increased, and the station at Frijoles was moved to the new townsite established on the relocated line of the Panama Railroad. As no substantial settlement was made at that point, however, the building was not occupied, the territory in that vicinity being covered by a patrol from the stations at Bas Obispo and Monte Lirio. The increase of population at Gatun, Pedro Miguel, and Miraflores has necessitated a strengthening of the force at these points, while at other points, because of a decrease

of population, a decrease in the police strength has accordingly resulted. No new buildings were constructed during the year. A regular patrol service is maintained over the harbors of Cristobal and Ancon for the purpose of enforcing the navigation laws. A boat patrol has also been established on the Gatun Lake area for the purpose of preventing the construction of huts and buildings below the ultimate level of the lake.

By the appointment of a special officer for the purpose of watching all incoming and outgoing steamships, particularly at the ports of Colon and Cristobal, it has been possible, during the fiscal year, to accomplish much good in the way of preventing the entry into the cities of Colon and Panama of persons engaged in the white-slave traffic. By an agreement made between the head of this department and the secretary of foreign affairs of the Republic of Panama, the quarantine officer of the commission at Colon and the late governor of the province of Colon were constituted as a board to determine what persons coming to Colon by ship were "undesirable" and should be denied the right of entering the Republic. A number of white-slave dealers and notorious prostitutes were thereby turned back and not permitted to debark, and yet others were deterred from attempting to come into the Republic. The question of the right of the office of foreign affairs to designate the governor of Colon as the Panaman representative of this board afterwards arose, and it was decided in the Panaman courts that the chief customs officer of the port of Colon alone could be so designated. Thereupon, by Panaman decree, the captain of the port of Colon was substituted, for the governor of the province, and the board thus constituted with the assistance of the aforesaid specially designated police officer has continued to perform this service. Houses of prostitution are not permitted in the Canal Zone, and the provisions of the act of Congress of March 26, 1910, against white-slave traffic, prohibiting such traffic in the Zone, are enforced. The proximity of the cities of Colon and Panama to the Canal Zone renders it important to Zone interests that the evils of the white-slave traffic and gambling be minimized as far as possible in those cities. Whatever affects the social well-being of of the two cities will, in more or less degree, affect the social well-being of the Zone.

On June 30, 1911, there were 148 convicts confined in the penitentiary at Culebra, as compared with 138 on June 30, 1910; 117 on June 30, 1909, and 108 on June 30, 1908. All convicts have been kept at work on public works in the Zone—particularly on road construction—except a sufficient detail to perform necessary work at the penitentiary. During the year several miles of the Panama-Gorgona public road were constructed by means of convict labor, thus completing this valuable macadam highway extending a distance of 19.7 miles from the city of Panama to the ultimate southern shores of Gatun Lake. Since the completion of this road the convicts have been employed in the construction of a 16-foot macadam roadway to extend from Empire to the Zone line over the general route of the old Chorrera trail. Panaman officials have given assurance that their Government will continue the construction of this roadway from the Zone line to Chorrera, a further distance of about 13 miles. This roadway will penetrate a country of fruit-growing, agricultural, and stock-raising value and will become a very important avenue of communi-



cation. In order to care for the convicts engaged in the construction of this road a stockade has been projected on the Manlingo River, about midway between Empire and the Zone line; here the prisoners will be housed and fed during their employment on this work.

Misdemeanor convicts were also used on public improvements wherever practicable, and especially on road and street maintenance. The total value of labor performed by district (jail) prisoners during the year, on a 10-cent per hour per prisoner basis, was \$22,329.40. Of this sum \$9,377 represents labor on public improvements (Canal Zone roads, streets, markets, public grounds, etc.), and \$12,952.40 represents janitor service in public buildings.

The value of the work performed by the penitentiary convicts, on the basis of 10 cents an hour for each convict, was \$25,348.80; and the cost of guarding, subsisting, and clothing the convicts was \$30,-788.05. Included in this amount is \$4,941.42, representing increased cost of guarding convicts on account of the work performed on public roads.

In order to provide suitable employment for prisoners who can not be employed to advantage on heavier outside work, a contract was secured for the manufacture of convict clothing for the Republic of Panama, and a small amount of clothing for insane patients at Ancon Hospital was also made.

Three thousand four hundred and forty-three writs of process in civil cases were served during the year. One hundred and fifty deaths were investigated by the chief of police or other members of the force, acting as coroner or deputy coroners. Of these, 30 resulted from drowning and 51 from railroad accidents. Investigations were also made into 662 accidents resulting in personal injuries.

During the year 111 persons of undesirable character were deported from the Canal Zone. At the expiration of their sentences practically all felons alien to the Canal Zone who had not established their residence in the Canal Zone prior to February 26, 1909, are deported. The total given includes such convicts. Two pardons were granted during the year and three sentences were commuted.

During the year the regulations prescribed for the government of the convicts in the penitentiary were amended to provide for a system of grading whereby the convicts are separated into five grades, namely, A, B, and C for outside grades and D and E for inside grades. Convicts upon entering the penitentiary are assigned to either of the lower grades, A or D, according to their fitness or the requirements of the public work, and upon earning a certain number of good conduct points are transferred to the higher grades, in which plain gray clothing is substituted for the striped costumes of the prisoners, and, finally, in outside work when prisoners by good conduct have reached the highest outside grade (C), they are divested of ball and chain provided to secure them. This system of grading, although it has been in effect but a few months, has yielded the most gratifying results. On July 10, 1911, of the total of 148 convicts 122 had, by conduct, earned promotion to the higher grades, and the infractions of prison rules have been reduced by more than one-half. Corporal punishment of prisoners is not permitted, other sufficiently adequate and more humane means being employed when it becomes necessary to inflict punishment.

The present penitentiary building at Culebra is inadequate for the number of convicts which have more recently been confined there, and some of the prisoners have in consequence been taken care of at the Culebra police station adjoining the penitentiary. This crowded condition will be relieved, however, upon the completion of the Chorrera Road stockade hereinbefore referred to.

Before the Empire-Chorrera Road is finished it is expected that a new location will be selected and a permanent penitentiary erected. It is expected that there will be connected therewith a farming tract of several hundred acres, to the end that convicts may be employed thereon and may be taught agriculture and fruit growing along simple, practical lines. Much of the farm can be planted in rubber, bananas, fruits, and other products which, with a minimum of labor, will yield good results. By means of the farm many food supplies will be produced for Zone prisoners and such prisoners as may not be employed on road construction and other public-improvement work in the Zone may always find employment on the farm.

#### DIVISION OF FIRE PROTECTION.

The organization of this division consists of 1 chief, 1 assistant chief, 1 clerk, 1 messenger, 7 captains, 7 lieutenants, 41 firemen, 1 engineer, 1 electrician, and 1 lineman.

During the year a new fire station was constructed and opened for service at Mount Hope. The building is a two-story frame, 16 by 20 feet, of the general type of station, designed for one paid fireman and a volunteer company. At Gatun a one-story building, 18 by 25 feet, was constructed on the west side of the locks to provide quarters for a paid fireman and a male nurse stationed for duty in the vicinity of the cement shed and docks. One-half of the cost of the building was paid by the department of sanitation and the other half by this department.

Owing to the placing of railroad tracks directly in front of the fire station at Cristobal in connection with the construction of the new docks there, it became necessary to select a new site for the fire station. Plans for the new building have been completed and the work is now in progress on a two-story concrete building 75 feet long and 56 feet wide, the ground floor to contain the apparatus and stalls for horses, while on the second floor will be located the office of the chief of the division of fire protection, sleeping quarters for the firemen, forage room, battery room, etc.

At Culebra, on account of the slides in the cut at that point, it became necessary to remove the fire station out of the danger zone.

A paid fireman was stationed at Toro Point in order to improve the conditions with respect to fire protection.

Two volunteer companies were disbanded during the year, as their continuance was no longer deemed necessary. One volunteer company was organized at Toro Point. On June 30, 1911, there were 18 volunteer companies, with a total of 295 members.

No new fire-alarm systems were established during the year. All the systems, five in number, were inspected, tested, and kept in working order by the electrician of the division. At the close of the year there were in use 45,675 feet of 2½-inch rubber-lined hose, 13,625 feet

of 2½-inch unlined hose, and 302 nozzles. Fourteen hundred and sixty-one chemical fire extinguishers were under the care of the division on June 30, 1911. Thirty-eight thousand four hundred and twenty-five inspections and 472 recharges of chemical extinguishers were made, and 290 were repainted. The inspection of buildings and fire-fighting apparatus distributed throughout the Zone and in buildings of the United States and Panama Railroad in the cities of Panama and Colon, on Culebra and Taboga Islands, at the Palo Seco Leper Asylum, and at Porto Bello and Nombre de Dios, was maintained.

The rules, regulations, and instructions for the government of the division of fire protection were revised during the year and approved by the Secretary of War on May 19, 1911.

Two hundred and fifty-two alarms of fire were responded to during the year, 14 of which were false alarms. Of the 238 actual fires, one was in the city of Panama and eight in the city of Colon; 147 fires were in Government property and 36 in property of the Panama Railroad Co. The value of Government and railroad property involved, including the buildings and their contents, as reported by the fire chief, was \$2,162,938.31, and the total loss is estimated at \$17,433.42 in Government property, and \$5,123.07 in property of the Panama Railroad Co. The average loss in all fires in Government and Panama Railroad property was \$123.26. The loss in the eight larger fires was \$21,404.95, while the amount of property involved is estimated at \$175,990.

The largest fire during the year originated in the city of Colon on March 23, 1911, and rapidly spread across the Canal Zone boundary into Cristobal, resulting in a property loss to the commission of \$14,394.93. On February 7, 1911, Panama Railroad Bridge No. 57½, across the canal near Paraiso, caught fire and, before it could be extinguished, caused a damage of \$3,127.60. The value of the bridge was \$12,000. A fire on March 18, 1911, in three Panama Railroad labor cars near the Ancon Quarry resulted in a loss of \$1,350, the value of the cars being \$3,000. A small storehouse at East Balboa was completely destroyed by fire on March 18, 1911, the loss being \$1,200.

The value of private property involved in the 24 fires reported is estimated by the fire chief at \$93,271.70, and the loss at \$31,320.95.

Three persons died from the result of burns received by explosions of alcohol, and one negro child was burned to death in a fire in the Canal Zone. Eight persons received burns by explosions of gasoline and alcohol, from which they recovered.

Satisfactory relations were maintained with the fire departments of the cities of Panama and Colon.

During the year there were performed extension of water mains, installation of fire hydrants, and the extension of roads to increase the efficiency of the division.

#### DIVISION OF PUBLIC WORKS.

The work of this division remains as described in previous reports. The organization of the division consists of 1 superintendent, 1 assistant superintendent, 6 clerks, 1 inspector and messenger, 2 inspectors of plumbing, 1 inspector of meters, 1 market inspector, 3

engineers, 6 foremen, 11 masons, 12 pipe fitters, 10 laborers, and 1 carpenter. The scope of its work in connection with the maintenance of the water, sewer, and street systems, and the collection of water rentals in the cities of Panama and Colon are indicated as follows:

On March 22, 1911, Mr. Maurice E. Gilmore was appointed superintendent of the division to succeed Mr. George H. Ruggles, resigned, and Mr. John J. Reidy, late acting superintendent, was appointed assistant superintendent.

In the city of Panama there were on June 30, 1910, 1,493 connections with the water and sewer mains, and 84 applications pending. On June 30, 1911, there were 1,809 connections and 42 applications for connections pending, an increase of 316 connections during the year. The installation of all plumbing resulting from these new connections, as well as repairs and extensions to existing plumbing, was inspected by the employees of the division.

The collections of water rents from private consumers for the first three quarters of the year in the city of Panama were \$57,693.45, and the net amount of the bills rendered for the quarter ended June 30, 1911, was \$20,913, a total for the year of \$78,606.45. The Republic of Panama was required to pay \$4,316.06 in addition to the total amount realized on collections in this city in order to liquidate, for the fiscal year, the proportionate part of the cost of the water, sewer, and street systems due under the general plan of amortization, together with interest and the expense of operation and maintenance. As the city makes no direct payment for public hydrants and taps, the amount paid by it on account of deficiency collections may be said to cover the water furnished through these hydrants, of which there are 154, and the average cost for each such hydrant and tap was therefore \$28.03 per annum. The population of the city of Panama is estimated at 46,214. For the fiscal year ended June 30, 1911, the total water consumption was 435,736,720 gallons, and the average daily consumption of water per capita was 25.8 gallons. The average annual charge per connection was \$47.01.

The water mains, hydrants, valves, taps, etc., were kept in order during the year. Meters were tested, repaired, and set, as needed, and sewers, manholes, and catch basins were kept clean and in working order.

In the city of Colon on June 30, 1910, there were 548 connections using water and 28 applications for connections pending. On June 30, 1911, there were 559 connections using water and 64 applications for connections pending; an increase during the year of 11 connections but an increase of 47 in the total number of contracts in force. A large number of the applications pending are for houses being rebuilt in the section of the city destroyed by fire in March, 1911. The installation of plumbing resulting from the connections and the repairs and extensions to existing plumbing were inspected by employees of the division. The water connections with property of the Panama Railroad Co. or the Isthmian Canal Commission are not included in the number of connections given above. The collections in Colon from private consumers and from the commission and the Panama Railroad Co. during the first three quarters of the year were \$57,818.80, and the net amount of bills rendered for the fourth quarter was \$18,614.30, a total for the year of \$76,433.10. The Republic of Panama was required to pay \$2,748.83 in addition to the total

amount realized on collections in Colon in order to liquidate, for the fiscal year, the proportionate part of the capital cost of the water, sewer, and street systems due, together with interest and the expense of operation and maintenance. The average charge per public hydrant or tap (of which there are 84) was therefore \$32.72 per annum. Estimating the population of Colon at 19,801, the average daily consumption of water per capita was 47.3 gallons, the total consumption for the year being 342,174,146 gallons. The average annual charge per private connection was \$106.30. The same character of maintenance work was performed in Colon as was performed in the city of Panama.

On September 30, 1910, new agreements or contracts were negotiated with the Republic of Panama, providing for the quarterly adjustment of all payments due by the Republic under the plan of amortization of the cost of the water, sewer, and street systems in the cities of Panama and Colon. These agreements are set forth in the appendices hereto attached. Under these new agreements (one being executed for the city of Panama and one for the city of Colon) the total amount due from the Republic to the United States Government at the beginning of each quarter is taken as the capital cost at that time. This capital cost due on March 31, 1911, was \$1,178,175.88 for the city of Panama, and \$912,605.78 for the city of Colon. Under the new form of agreement, one-fourth of the capital cost due at the close of each quarter is taken as the installment of such capital cost to be paid as of that date, and to be added thereto is interest on the capital cost for the quarter, together with the quarter's maintenance and operation charges; applied to the payment of these items is the total amount collected on account of water rents during the quarter, and if the difference is in favor of the United States Government the Republic of Panama pays such difference; while, on the other hand, if the difference is in favor of the Republic of Panama, that is to say, if the water rentals exceed the total sum due the United States on the quarterly settlement, the same is credited on the capital cost due.

At present, as hereinbefore shown, the quarterly water rental collections in the two cities have been insufficient during the fiscal year to liquidate the quarterly payments thus due to the United States Government. As already shown, the amount paid by the Republic to the United States for the fiscal year closed, on this account, was the sum of \$7,064.89; but as no specific charges are made for water furnished in these two cities for street sprinkling and fire services, for public taps, toilets, etc., the deficit thus met by the Panaman Government may be said to represent the cost of this public water service. Eventually, and at no distant date, the water rentals should equal or exceed the quarterly sums due the United States Government. The cost of the operation and maintenance of the water, sewer, and street systems in the cities of Panama and Colon for the fiscal year is set forth in Tables 32 and 33 in the appendices to this report.

The sanitary improvements, which, under the act of Congress of March 4, 1909, were authorized for construction in the cities of Panama and Colon, were, during the fiscal year, completed in the city of Panama and turned over to the division of public works for maintenance on November 17, 1910, but were not, at the close of the fiscal year, wholly completed in the city of Colon. The act appro-

appropriated \$800,000 for these improvements, and the whole of same will be expended.

The rules and regulations governing the use of water and sewers in the cities of Panama and Colon were amended to permit the adjustment or the reduction of excessive water bills where the waste of water is caused by underground leaks. Under the provisions of this amendment, reductions in bills aggregating \$1,319.75 for Panama and \$1,438 for Colon were made. Refunds were made of \$403.55 in Panama, and \$220.80 in Colon on account of overpayments. The rates, rules, and regulations governing the use of water and sewers in the cities of Panama and Colon were further amended to provide for a charge of \$1 for turning the water off, and a like charge for turning it on again, in the case of delinquent water consumers; same, upon nonpayment, to become a lien on the property.

In the Canal Zone on June 30, 1910, there were 516 private connections with the water and sewer mains. On June 30, 1911, there were 615 connections, an increase of 99. All of the plumbing installations resulting from these connections, as well as the repairs and extensions to existing plumbing, were inspected by employees of the division.

The rates, rules, and regulations governing the use of water in the Canal Zone were amended by an ordinance enacted by the Isthmian Canal Commission on January 28, 1911, providing for the payment of a fee of \$1 for turning off water on account of failure to pay water rents, and a similar fee for turning the water on again after the payment of such delinquent bills; same, upon nonpayment, to become a lien on the property.

Zone water bills of a net amount of \$19,362.25 were prepared and forwarded to the collector of revenues for collection, as compared with \$12,239.65 during the previous year.

Nine public markets under the direction of this division were in operation, and a revenue of \$4,786.67 was derived from the rental of space therein.

At the two public slaughterhouses of the Zone (one at Empire and the other at Gorgona) 3,927 cattle, 685 hogs, 12 goats, and 1 sheep were slaughtered.

During the year 4.15 miles of road were, by prison labor, constructed for the Canal Zone government, under the engineering supervision of the central and Pacific divisions. Work is now in progress on a macadamized road, 16 feet in width, from Empire to the Canal Zone boundary in the direction of La Chorrera, and more fully described under the caption of "Division of police and prisons." Recommendations were made, or advice given, respecting other public improvements in the Zone paid for from funds raised by taxation and are described elsewhere in this report.

The expense of constructing public roads in the Canal Zone must be altogether paid out of allotments of Zone funds derived from local revenues. As such funds are limited, and as road building and maintenance on the Isthmus are expensive matters, the Zone government—although it has done much, and all within its power, in the way of road construction—has been unable to make the progress to be desired. The Zone government has built a total of 36 miles of macadam roadway, of widths ranging from 12 to 16 feet. This is exclu-

sive of the Savanas highway, soon to be ceded to the Panaman Government, and streets built by the commission for commission purposes. From the standpoint of military and canal needs, a complete system of macadamized roads dominating the Zone would seem to be necessary; and because of the facts stated I believe that the National Government should, through appropriate action, assist the Zone government in building new roads and in widening and strengthening some of the Zone roads already constructed.

#### DIVISION OF SCHOOLS.

The organization of this division consists of 1 superintendent, 2 clerks, 1 supervisor of upper grades, 1 supervisor of primary grades, 2 supervisors of children, 1 principal of high school, 5 principals of grammar schools, 61 teachers, and 1 gardener temporarily employed.

The schools for the year 1910-11 opened on October 1, 1910, with an enrollment in that month of 1,837 children—931 in the white and 906 in the colored schools—and the year was, perhaps, the most successful one in the history of the Canal Zone schools. The highest monthly enrollment was in June, when 1,410 pupils were enrolled in the white schools and 1,568 in the colored schools. As hereinafter shown, school consolidations were had, with the effect of securing more efficient grading and instruction. The high grade of teachers in the white schools was maintained, while more efficient teachers for the colored schools were secured, largely through the kind assistance of the supervising inspector of schools of the island of Jamaica. Since most of the colored pupils are West Indians, it has been found that it is best to secure Jamaican teachers for the colored schools.

Early in the school year the schools at Colon Beach, Las Cascadas, and Corozal were consolidated with those at Cristobal, Empire, and Ancon, respectively. This plan insures better grading and more efficient instruction, and it has met with almost unanimous approval by the school patrons. Pupils living in communities where there are no schools, or where grades suitable to their advancement are not available, are furnished transportation over the Panama Railroad. Breaks or large carryalls are also used to transport pupils to and from schools, viz, from Balboa and Corozal to and from Ancon, from Las Cascadas to and from Empire, and from Colon to and from Cristobal. Under this plan 10 schools for white children and 15 for colored children were maintained throughout the year. One additional white school and two additional colored schools were maintained a part of the year. At Bas Obispo a school was opened on December 19, 1910, in order to provide instruction for children in the lower grades, obviating the necessity of having small children travel to other points in order to attend school. A school for colored children was established at Pedro Miguel on November 21, 1910. On March 23, 1911, the colored school building at Cristobal was destroyed by fire, and the new building was not completed in sufficient time to justify the reopening of the school before the close of the year.

The Canal Zone High School was transferred from Cristobal to Gatun, where proper facilities were provided by the construction of a five-room second-story addition to the grade school at that point, and high-school pupils were transported from other Zone points to Gatun by rail. A branch high school was also maintained at Ancon, in the

white school building, where freshmen class work, coincident with that of the Gatun High School, was done. The high-school curriculum comprehends a full four years' course, and during the year laboratory equipment costing \$132.50 was purchased for use in connection with the course in physics. There were two high-school graduates, these being the first to complete the Zone high-school course.

School gardens were maintained in connection with the colored schools, as described in the last annual report. The estimated value of the products from the school gardens is \$783.53, or more than twice the amount derived from the same source during the previous fiscal year.

During the year the sum of \$576 was collected for tuition, an increase of \$452.65 over the previous year. This increase is due primarily to the change in the tuition fee mentioned in the last annual report.

New buildings for colored children were constructed at Cristobal, Cruces, and Pedro Miguel. The school buildings at Las Cascadas and Corozal, being no longer required at those points by reason of the consolidation of those schools with the schools at Empire and Ancon, were transferred to the quartermaster department of the commission and proper credit was given the division of schools therefor. The school building at Colon Beach reverted to the Panama Railroad Co. under the agreement for its construction when that school was consolidated with the Cristobal school.

Besides the construction of a second-story addition to the Gatun white school building, five-room additions were made to the buildings for white children at Empire and Ancon.

On June 30, 1911, there were 27 school buildings, 11 for white schools and 16 for colored schools. These buildings are constructed with special reference to the needs in the Tropics and are equipped with adjustable sanitary steel desks, blackboards, and other up-to-date furnishings. Encyclopedias and dictionaries, historical, literary, scientific, art, and other works are provided for the pupils; and free textbooks and free medical inspection are also furnished the pupils. During the school year instruction in music has been inaugurated in the white schools, and the results obtained have been gratifying. Calisthenic drills are given, and at the larger schools there are provided for the children swings, horizontal bars, ladders, and similar equipment for play and athletic purposes.

Since January of the present year systematic medical inspection of the pupils has been had, and most of the children who have been found physically defective have been treated in the Zone hospitals. This work has resulted in much good. Dangerous diseases in the schools have been limited to a few doubtful cases of diphtheria and one case of scarlet fever. For the common drinking cup there has been substituted in the schools individual cups furnished by the pupils.

During the fiscal year I recommended the establishment, at some convenient point, of an industrial school conducted along simple, practical lines, wherein the more advanced colored children of the Zone might receive instruction, the boys in agriculture and in some simpler forms of manual labor, and the girls in sewing, cooking, and domestic labor. I hope that such school may be established, as I believe it can accomplish much good.



The requirements for eligibility for appointment as teachers in the white schools have been maintained, namely, two years' successful experience as a teacher, certified to by two or more persons engaged in educational work, graduation from a certified high school requiring four years of work or the equivalent, and two years' additional professional or academic training. The number of applicants for positions as teachers in the white schools continues to be very large, there being on file at the close of the fiscal year something like 400 applications. Most of the teachers employed during the school year have indicated their desire to teach in the Zone during the approaching year, and therefore there will not be many teachers' places to be filled by new teachers when schools reopen on October 1 next.

#### PROSECUTING ATTORNEY'S OFFICE.

In accordance with the order of the chairman, dated October 4, 1910, and approved by the Acting Secretary of War, all legal matters of the commission were placed under the supervision of the counsel and chief attorney, and the data heretofore published under this head will be found in the report submitted by the head of the department of law.

#### CANAL ZONE FUNDS.

The act of Congress approved March 4, 1911, provides that all funds collected by the government of the Canal Zone from rentals of public lands and buildings in the Canal Zone and the cities of Panama and Colon, from the Zone postal service, and from court fees and fines, and all sums collected or raised by taxation, in whatever form, under the laws of the government of the Canal Zone, are appropriated until and including June 30, 1912, as follows: The revenues derived from the postal service, to the maintenance of that service; and the remaining revenues, including any balances unexpended in prior years, after setting aside a miscellaneous and contingent fund of not exceeding \$10,000, to the maintenance of the public-school system of the Zone, to the construction and maintenance of public improvements within the Zone, to the maintenance of the administrative districts, to the maintenance of Canal Zone charity patients in the hospitals of the Isthmian Canal Commission, and to the maintenance of administrative district prisoners.

At the beginning of the fiscal year there was a balance of \$73,181.79 on hand in the Zone treasury, and during the year there was collected \$426,963.33, of which \$22,924.38 was in the hands of collecting officers at the close of the fiscal year. The expenditures amounted to \$280,013.15. The estimated revenues of the Canal Zone during the current fiscal year (1912) are \$220,000, exclusive of postal receipts, and will be expended, approximately, as follows:

Maintenance of schools.....	\$90,000
Expenses of district courts.....	20,000
Maintenance of pauper sick in Isthmian Canal Commission hospitals.....	2,400
Maintenance of misdemeanor prisoners.....	15,000
Maintenance of markets and slaughterhouses.....	4,000
Construction, repair, maintenance, and operation of roads, trails, bridges, waterworks and sewers, and other miscellaneous public works and improvements.....	78,600
Miscellaneous and contingent expenses.....	10,000
Total .....	220,000

The postal revenues during the current year will, it is estimated, amount to approximately \$100,000, and they will be applied toward the maintenance of the postal service.

The organization of the office of the treasurer of the Canal Zone government consists of one treasurer, one assistant treasurer, and two clerks.

#### COURTS.

The supreme court held 16 sessions during the year. It affirmed the decision of the circuit court in three criminal cases and reversed the decision of that court in two criminal cases. Six civil cases were pending in the court at the beginning of the year, 9 were filed, and 11 were disposed of. Five attorneys were admitted to practice in the courts of the Canal Zone.

In the circuit court 374 criminal cases were filed. The defendants in 234 cases were convicted and 78 were acquitted, 43 cases were dismissed, and 19 cases were pending on June 30. There were 339 civil cases filed during the year; 231 were disposed of, and 108 were pending at the end of the year.

In the district courts 5,862 criminal cases were filed. The defendants were convicted in 4,464 cases and acquitted in 847 cases, 243 cases were dismissed, 304 cases were appealed to the circuit courts, and 4 cases were yet pending in the district courts on June 30. Nine hundred and forty-eight civil cases were filed during the year, 918 were disposed of, and 30 were pending at the close of the year.

The organization of the judiciary consists of 1 chief justice, 2 associate justices, 5 district judges, 8 clerks, 2 translators, and 2 messengers.

The term of Circuit Judge Lorin C. Collins, of the third judicial circuit, expired on January 2, 1911, and on April 8, 1911, Judge Thomas E. Brown, jr., late district judge at Cristobal, was by the Executive order of the President, dated March 16, 1911, appointed to succeed him. On April 7, 1911, Circuit Judge Wesley M. Owen, of the second judicial circuit, resigned, and by the Executive order of the President, dated March 16, 1911, W. W. Warwick, late examiner of accounts, was appointed to succeed him but did not qualify, and this judgeship has been vacant ever since Judge Owen's resignation. On April 18, 1911, William H. Jackson was appointed district judge to fill the vacancy caused by the resignation of District Judge Brown, as stated above, and served in that capacity from May 5, 1911, until June 5, 1911, when he was assigned to duty as senior district judge in the stead of District Judge Rerdell, who in turn was assigned to duty as regular district judge at Cristobal.

#### APPENDICES.

Attention is called to the statements attached as appendices to this report, which indicate in detail the business transacted throughout the department. There are also attached appendices showing the organization of the various divisions making up the department of civil administration.

Very respectfully,

M. H. THATCHER,  
*Head of Department of Civil Administration.*

Col. GEORGE W. GOETHALS, U. S. Army,  
*Chairman, Isthmian Canal Commission.*

## APPENDICES TO REPORT OF THE HEAD OF THE DEPARTMENT OF CIVIL ADMINISTRATION.

## APPENDIX I.

- TABLE 1.—Sale of postage stamps and collections on account of second-class mail matter, by months, during the fiscal year ended June 30, 1911.
- TABLE 2.—Letters and parcels registered, by offices, during the fiscal year ended June 30, 1911.
- TABLE 3.—Number of dispatches of mail from the exchange office at Cristobal and number of pouches, sacks, and registered sacks handled by railway-mail messengers during the fiscal year ended June 30, 1911.
- TABLE 4.—Destination of dispatches of mail by the exchange office at Cristobal during the fiscal year ended June 30, 1911.
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## LEGISLATION.

1. Executive order of the President, July 25, 1910, authorizing the Isthmian Canal Commission to establish rules and regulations to facilitate and protect the work of the Panama Canal.
2. Executive order of the President, July 28, 1910, prescribing the jurisdiction of Canal Zone courts in civil cases where both defendant and plaintiff are non-residents of the Canal Zone.
3. Executive order of the President, August 20, 1910, respecting the conveyance of real estate by married women.
4. Executive order of the President, October 4, 1910, abolishing the position of tax collector, creating the position of deputy collector of revenues, and amending the laws governing taxes.
5. Executive order of the President, October 7, 1910, to prescribe the manner of leasing public lands in the Canal Zone.
6. Executive order of the Secretary of War, January 5, 1911, amendment to section 1 of executive order of the Secretary of War, dated December 3, 1904 (Taft agreement).
7. Executive order of the President, January 19, 1911, to create a land office for the Canal Zone and for other purposes.
8. Executive order of the President, February 2, 1911, providing a method of executing and recording deeds, and repealing the Executive order dated March 12, 1907, effective April 15, 1907.
9. Executive order of the President, May 2, 1911, providing for the punishment of persons who return to the Isthmus after having been convicted and sentenced to imprisonment in the Canal Zone and thereafter deported.
10. Executive order of the President, May 6, 1911, respecting the arrest and discharge of deserting seamen.
11. Executive order of the President, May 10, 1911, Government of the Insane Asylum for the Canal Zone.
12. Executive order of the President, May 11, 1911, providing for the punishment of persons riding on railway trains in the Canal Zone without the consent of persons in charge of trains.
13. Executive order of the President, May 13, 1911, providing for the collection of a distillation tax in the Canal Zone, to become effective 30 days from the date thereof.
14. Executive order of the President, June 12, 1911, amending Executive order of May 13, 1911, respecting distillation tax in the Canal Zone, by making the effective date thereof August 13, 1911.
15. Executive order of the President, June 28, 1911, providing for the execution of revocable licenses for lots in town sites in the Canal Zone.

## ORDINANCES.

1. Ordinance enacted by the Isthmian Canal Commission, August 25, 1910, and approved by the Acting Secretary of War, October 31, 1910, providing for the licensing and regulation of motor vehicles in the Canal Zone.
2. Ordinance enacted by the Isthmian Canal Commission, August 25, 1910, and approved by the Acting Secretary of War, October 31, 1910, amendment to paragraph "a," section 7, of the "Regulations providing for certain taxes and licenses in the Canal Zone other than for the sale of intoxicating liquors." (Ordinance No. 11.)
3. Ordinance enacted by the Isthmian Canal Commission, August 25, 1910, and approved by the Secretary of War, December 3, 1910, providing for the fixing of rates of charges to be made for the transportation of passengers over the streets and roads of the Canal Zone.
4. Ordinance enacted by the Isthmian Canal Commission, January 28, 1911, and approved by the Secretary of War February 11, 1911, amendment to section 4 of the "Rates, rules, and regulations governing the use of water in the Canal Zone." (Ordinance No. 7.)
5. Ordinance enacted by the Isthmian Canal Commission, April 15, 1911, and approved by the Secretary of War, April 26, 1911, providing for the licensing and regulation of bicycles in the Canal Zone.
6. Ordinance enacted by the Isthmian Canal Commission, April 15, 1911, and approved by the Secretary of War, April 26, 1911, providing for the licensing of chauffeurs for automobiles.
7. Ordinance enacted by the Isthmian Canal Commission, April 15, 1911, and approved by the Secretary of War, April 26, 1911, prohibiting hunting and other trespassing upon reservoirs and watersheds of the Canal Zone.
8. Ordinance enacted by the Isthmian Canal Commission, April 29, 1911, and approved by the Secretary of War, May 19, 1911, establishing rules, regulations, and instructions for the government of the division of fire protection of the Canal Zone.

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TABLE 1.—Sale of postage stamps and collections on account of second-class mail matter, by months, during the fiscal year ended June 30, 1911.

Months.	First class.	Second class.	Months.	First class.	Second class.
1910			1911		
July.....	\$6,888.00	\$3.10	January.....	\$6,703.90	\$2.48
August.....	6,397.20	2.05	February.....	6,599.80	3.61
September.....	7,318.50	3.57	March.....	8,335.88	3.15
October.....	6,167.45	3.03	April.....	6,051.00	.10
November.....	6,585.05	2.67	May.....	6,255.78	.45
December.....	8,956.00	3.65	June.....	6,656.65	.65
			Total.....	82,865.21	28.51

TABLE 2.—*Letters and parcels registered, by offices, during the fiscal year ended June 30, 1911.*

Name of post office.	Domestic letters registered.	Domestic parcels registered.	Foreign letters registered.	Foreign parcels registered.	Official registered, free.	Distribution, reregistered, free.	Total.
Ancon.....	3,050	850	5,260	350	16,329	364	26,221
Balboa.....	1,444	184	1,311	47	1,375	81	4,442
Bas Obispo.....	499	44	542	3	1,560	87	2,635
Bohio.....	116	2	390	4	247	.....	759
Corozal.....	438	113	337	16	2,013	38	2,955
Culebra.....	1,542	294	2,719	74	5,147	4	9,919
Cristobal.....	6,262	1,388	10,639	285	7,927	605	27,106
Empire.....	2,824	636	4,825	115	17,642	165	26,207
Gatun.....	2,594	588	6,552	98	3,833	326	13,991
Gorgona.....	1,961	489	1,963	87	3,028	35	7,563
Las Cascadas.....	763	167	1,302	22	2,181	42	4,479
Matachin.....	161	38	515	8	403	25	1,150
Miraflores.....	230	25	1,033	31	930	4	2,253
Paraiso.....	396	58	1,216	12	780	32	2,494
Pedro Miguel.....	601	177	846	15	2,821	69	4,529
San Pablo.....	224	5	544	4	1,238	104	2,119
Tabernilla.....	321	61	474	6	1,491	50	2,403
Total.....	23,435	5,119	40,477	1,177	68,945	2,031	141,225

TABLE 3.—*Number of dispatches of mail from the exchange office at Cristobal, and number of pouches, sacks, and registered sacks handled by railway mail messengers during the fiscal year ended June 30, 1911.*

Months.	Pouches.	Sacks.	Registered sacks.	Total.	Dispatches.
1910.					
July.....	4,143	760	298	5,201	100
August.....	3,548	927	142	4,617	98
September.....	3,717	1,093	223	5,033	84
October.....	4,703	1,371	342	6,416	105
November.....	4,274	1,314	340	5,928	97
December.....	4,637	1,402	287	6,326	103
1911.					
January.....	4,710	1,377	344	6,431	102
February.....	3,899	1,454	266	5,619	89
March.....	3,970	1,479	318	5,767	103
April.....	3,370	1,073	295	4,738	93
May.....	4,105	1,330	291	5,726	98
June.....	3,410	1,126	343	4,879	101
Total.....	48,486	14,706	3,489	66,681	1,173

TABLE 4.—*Destination of dispatches of mail by the exchange office at Cristobal during the fiscal year ended June 30, 1911.*

To—	Dis-patches.	To—	Dis-patches.
New York, by Panama R. R., Pacific Mail, Hamburg-American steamers.....	127	Antigua.....	27
New Orleans, La. (States mail).....	53	British Guiana.....	30
Jamaica.....	111	Grenada.....	34
Barbados and Dis.....	32	St. Vincent.....	30
Trinidad and Dis.....	36	Cartagena, Colombia.....	10
Port Limon, Costa Rica.....	68	St. Lucia.....	3
French lines, Colon-Bordeaux, Colon-St. Nazaire.....	23	Colon, R. de P.....	566
Martinique via French Line.....	23	Total.....	1,173

TABLE 5.—*Money orders issued, by months, during fiscal year ended June 30, 1911.*

Months.	Orders issued.	On the United States.	On the Canal Zone.	On Martini-que.	On Costa Rica.	Amount.	Fees.
1910.							
July.....	17,269	\$335,843.40	\$106,775.04	\$546.00		\$443,164.44	\$1,936.03
August.....	16,176	324,925.11	99,138.25	402.50		424,465.86	1,836.25
September.....	17,973	354,692.30	110,833.98	601.00		466,127.28	2,025.55
October.....	16,784	320,697.13	108,152.69	361.88		429,211.70	1,862.06
November.....	17,828	337,127.27	97,230.28	548.00		434,905.55	1,938.85
December.....	21,748	372,049.57	100,512.34	470.50		473,032.41	2,201.91
1911.							
January.....	16,751	308,894.55	104,601.09	468.50		413,964.14	1,828.06
February.....	17,431	340,013.03	104,585.19	588.50		445,186.72	1,946.26
March.....	20,065	369,546.23	125,491.45	943.50	\$10.00	495,991.18	2,188.93
April.....	17,933	335,854.11	113,893.76	565.70	159.00	450,472.57	1,976.87
May.....	16,564	292,031.59	97,895.91	355.70	47.00	390,330.20	1,757.63
June.....	18,228	323,144.91	114,293.14	388.00	228.50	438,054.55	1,956.70
Total.....	214,780	4,014,819.20	1,283,403.12	6,239.78	444.50	5,304,906.60	23,455.09

Average value of orders, \$24.69.

TABLE 6.—*Money orders paid and repaid during fiscal year ended June 30, 1911.*

Months.	Amount.	Months.	Amount.
1910.			
July.....	\$128,875.18	January.....	\$87,452.09
August.....	113,251.23	February.....	94,180.34
September.....	135,548.97	March.....	128,436.77
October.....	104,784.68	April.....	121,382.72
November.....	98,421.76	May.....	119,774.58
December.....	128,256.81	June.....	136,756.33
Total.....			1,397,119.96

TABLE 7.—*Amount of money orders, by offices, payable to the remitter and drawn on the issuing office, remaining unpaid on June 30, 1911.*

Offices.	Amount.	Offices.	Amount.
Ancon.....	\$12,042.00	Las Cascadas.....	\$24,657.75
Balboa.....	20,491.98	Matachin.....	4,837.00
Bas Obispo.....	11,597.34	Miraflores.....	15,212.20
Corozal.....	10,806.45	Paraiso.....	15,367.85
Cristobal.....	35,631.55	Pedro Miguel.....	39,856.95
Culebra.....	22,302.65	San Pablo.....	3,873.50
Empire.....	15,501.08	Tabernilla.....	3,657.00
Gatun.....	51,600.00	Total.....	332,141.60
Gorgona.....	44,706.30		

TABLE 8.—*Customs operations at the port of Ancon during the fiscal year ended June 30, 1911.*

Nationality.	Class.	Entering.		Clearing.	
		Number.	Tonnage.	Number.	Tonnage.
American.....	Steam.....	94	162,615	91	155,672
Do.....	Sail.....	3	4,956	2	3,504
British.....	Steam.....	119	194,841	120	197,033
Peruvian.....	do.....	17	30,323	16	27,892
Chilean.....	do.....	25	47,593	28	53,156
Norwegian.....	do.....	5	14,655	5	14,655
German.....	do.....	1	2,463	1	2,463
Total.....		264	457,746	263	454,672

Number of vessels in port from last year.....	6
Tonnage in port from last year.....	9,952
Number of vessels remaining in port.....	7
Tonnage remaining in port.....	13,126
Services to American seamen:	
Seamen shipped.....	537
Seamen discharged.....	419
Seamen deserted.....	34
Seamen deceased.....	1
Movement of passengers and cargo:	
Tons of cargo arriving—	
In transit.....	243,908
Local.....	101,051
Number of barrels of oil arriving, local.....	282,000
Tons of cargo departing—	
In transit.....	253,518
Local.....	723.5
Passengers arriving—	
Cabin.....	3,496
Steerage.....	1,747
	5,243
Passengers departing—	
Cabin.....	3,147
Steerage.....	1,578
	4,725
Services to Chinese:	
Chinese arriving.....	188
Chinese transferred to other ships.....	11
Chinese returned to port of embarkation.....	1
Chinese escaped.....	0

TABLE 9.—Customs operations at the port of Cristobal during the fiscal year ended June 30, 1911.

Nationality.	Class.	Entering.		Clearing.	
		Number.	Tonnage.	Number.	Tonnage.
American.....	Steam.....	97	357,905	98	364,100
British.....	do.....	67	152,249	66	147,399
Do.....	Schooner.....	2	498	2	498
Norwegian.....	Steam.....	85	196,446	86	200,186
Danish.....	do.....	4	10,922	4	10,922
Do.....	Schooner.....	1	135	1	135
Panamanian.....	Steam.....	1	454	1	454
Do.....	Schooner.....	2	60	2	60
Do.....	Launch.....	1	9	1	9
Swedish.....	Steam.....	1	1,194	1	1,194
German.....	do.....	1	1,596	1	1,596
Belgian.....	do.....	1	1,402	1	1,402
Total.....		263	722,870	264	727,955

Number of vessels in port from last year.....	6
Tonnage in port from last year.....	17,717
Number of vessels remaining in port.....	5
Tonnage remaining in port.....	12,632
Services to American seamen:	
Seamen shipped.....	97
Seamen discharged.....	51
Seamen deserted.....	34
Seamen deceased.....	0
Movement of passengers and cargo:	
Tons of cargo arriving—	
In transit.....	113,847
Local.....	1,026,245
Tons of cargo departing—	
In transit.....	133,800
Local.....	71,530
Passengers arriving—	
Cabin.....	6,382
Steerage.....	563
	6,945
Passengers departing—	
Cabin.....	5,640
Steerage.....	1,306
	6,946



TABLE 10.—*Distillation taxes collected during the fiscal year ended June 30, 1911.*

Months.	Licenses.	Amount.	Months.	Licenses.	Amount.
1910.			1911.		
July.....	6	\$267.02	January.....	1	\$42.84
August.....	7	261.27	February.....	2	68.16
September.....	5	223.41	March.....	7	246.61
October.....	5	157.33	April.....	6	264.16
November.....	4	107.65	May.....	7	343.25
December.....	8	256.54	June.....	11	306.74
			Total.....	69	2,544.98

TABLE 11.—*Collections on account of saloon licenses during fiscal year ended June 30, 1911.*

	July 1, 1910.		Jan. 1, 1911.	
	Licenses.	Amount.	Licenses.	Amount.
Ancon.....				
Cristobal.....	11	\$6,600.00	11	\$6,600.00
Empire.....	27	16,200.00	29	17,400.00
Gorgona.....	19	11,400.00	17	10,200.00
Total.....	57	34,200.00	57	34,200.00

Total amount, \$68,400.

TABLE 12.—*Land and building rents collected during the fiscal year ended June 30, 1911.*

Months.	Lands.	Buildings.	Total.
1910.			
July.....	\$1,317.03	\$598.67	\$1,915.70
August.....	1,102.18	459.00	1,561.18
September.....	1,409.54	207.00	1,706.54
October.....	2,002.37	332.00	2,334.37
November.....	2,503.83	339.50	2,843.33
December.....	1,682.88	455.00	2,137.88
1911.			
January.....	2,942.09	334.00	3,276.09
February.....	1,552.45	295.00	1,847.45
March.....	1,921.87	297.00	2,218.87
April.....	1,143.88	297.00	1,440.88
May.....	530.15	280.00	810.15
June.....	895.43	481.35	1,376.78
Total.....	19,093.70	4,375.52	23,469.22

TABLE 13.—*Statement, by months, of estates of deceased American employees administered by the administrator of estates during the fiscal year ended June 30, 1911.*

	Received.	Settled.	Amount of funds collected.
On hand and unsettled July 1, 1910.....	17		
1910.			
July.....	1	9	\$269.97
August.....	3	1	78.08
September.....			136.77
October.....	7	4	704.95
November.....	4	2	802.44
December.....	4	4	467.12
1911.			
January.....	5	1	652.44
February.....	1	2	248.87
March.....	4	8	505.23
April.....			.67
May.....	3	4	427.12
June.....	2	8	454.80
Total.....	51	43	4,748.46

Number of estates remaining unsettled June 30, 1911, 8.

TABLE 14.—*Estates escheated to the Canal Zone government on petition of the collector of revenues during the fiscal year ended June 30, 1911.*

	Number.	Amount.		Number.	Amount.
1910.			1911.		
July.....	7	\$1,124.60	January.....		
August.....	1	479.17	February.....		
September.....			March.....		
October.....			April.....		
November.....			May.....		
December.....			June.....		
			Total.....	8	\$1,603.77

## APPENDIX II.—DIVISION OF POLICE AND PRISONS.

TABLE 15.—*Authorized strength of division of police and prisons June 30, 1911.*

Official titles.	Number.	Salary.	Official titles.	Number.	Salary.
Chief of police.....	1	\$4,000	First-class policemen.....	16	\$980
Assistant chief of police.....	1	3,300	Policemen.....	11	600
Inspectors.....	2	2,100	Do.....	40	540
Lieutenants.....	4	1,920	Do.....	65	480
Sergeants.....	4	1,890	Senior clerk.....	1	2,100
Do.....	4	1,710	Clerk.....	1	1,800
Corporals.....	10	1,560	Do.....	1	1,650
Do.....	10	1,470	Clerks.....	2	1,500
First-class policemen.....	40	1,290			
Do.....	30	1,200	Total authorized strength of division.....	274	
First-class policeman (special).....	1	1,200			
First-class policemen.....	30	1,080			

TABLE 16.—*Actual strength of division of police and prisons on June 30, 1904-1911.*

Official titles.	1904	1905	1906	1907	1908	1909	1910	1911
Chief of police.....	1	1	1	1	1	1	1	1
Assistant chief of police.....							1	1
Chief clerk.....		1	1	1	1	1		
Senior clerk.....							1	1
Clerks.....	1	4	5	6	8	5	4	4
Copyist.....					1			
Inspectors.....							2	2
First lieutenant.....	1	1	1	1	1	1		
Second lieutenant.....			1	1	1	1		
Lieutenants.....							4	4
First-class sergeants.....		4	9	6				
Sergeants.....	6	4	9	6	10	11	8	8
Corporals.....	2	3	15	13	18	18	20	20
First-class policemen.....		16	23	59	108	117	112	114
Policemen.....	75	98	155	90	93	96	111	115
Engineer, police launch.....						1		
Sailor, police launch.....						1		
Total.....	86	132	220	184	242	253	264	270

TABLE 17.—*Actual strength of stations and substations on June 30, 1911.*

Stations.	Strength.	Stations.	Strength.
Headquarters.....	11	Gorgona.....	19
Detective force.....	6	Bas Obispo.....	5
	17	Matachin.....	4
		San Pablo.....	2
Ancon.....	27	Tabernilla.....	4
Balboa.....	20	Frijoles.....	
Las Babanas.....	2		
Corozal.....	4		34
Miraflores.....	6	Cristobal.....	41
Pedro Miguel.....	7	Bohio.....	3
	66	Oatun.....	19
Empire.....	30	Monte Lirio.....	1
Paraiso.....	4	Mt. Hope.....	4
Cucaracha.....	1	Porto Bello.....	4
Culebra.....	13	Toro Point.....	4
Las Cascadas.....	6		76
	54	Penitentiary.....	23
		Total.....	270

TABLE 18.—*Number of arrests, by fiscal years, made in the Canal Zone since organization of division of police and prisons.*

Periods.	Arrests.	Periods.	Arrests.
June 2, 1904, to June 30, 1905.....	2,130	July 1, 1909, to June 30, 1910.....	6,947
July 1, 1905, to June 30, 1906.....	3,748	July 1, 1910, to June 30, 1911.....	5,959
July 1, 1906, to June 30, 1907.....	5,831		
July 1, 1907, to June 30, 1908.....	6,075	Total.....	36,965
July 1, 1908, to June 30, 1909.....	6,275		

TABLE 19.—*Number of arrests, by months, made during fiscal year ended June 30, 1911.*

Months.	Arrests.	Months.	Arrests.
1910.		1911.	
July.....	572	January.....	394
August.....	618	February.....	496
September.....	500	March.....	442
October.....	474	April.....	536
November.....	471	May.....	469
December.....	545	June.....	472
		Total.....	5,959
		Arrests with warrant.....	1,505
		Arrests without warrant.....	4,454

TABLE 20.—Statement of convictions of persons arrested during fiscal year ended June 30, 1911.

	Total arrested.	Convic- tions.		Total arrested.	Convic- tions.
1910.			1911.		
July.....	572	501	January.....	384	322
August.....	618	513	February.....	486	389
September.....	500	373	March.....	442	362
October.....	474	372	April.....	526	429
November.....	471	341	May.....	469	368
December.....	545	487	June.....	472	357
			Total.....	5,969	4,764

TABLE 21.—Charges against persons arrested during the fiscal year ended June 30, 1911.

Offenses.	Male.	Female.	Total.	Offenses.	Male.	Female.	Total.
Abandoning child.....		1	1	Keeping disorderly house.....	1	4	5
Abduction.....	1		1	Lewd and lascivious cohabitation.....	31	29	60
Adultery.....	9	11	20	Libel.....	1		1
Allowing animals to run at large.....	3		3	Lottering.....	334	10	344
Assault.....	40	3	43	Malignous mischief.....	51	7	58
Assault and battery.....	414	43	457	Manslaughter.....	3		3
Assault with deadly weapon.....	61		61	Mayhem.....	1	1	2
Assault with attempt to commit murder.....	4	1	5	Mendicancy.....	1		1
Attempt to defraud.....	47	2	49	Murder.....	5		5
Attempted manslaughter.....	1		1	Nonsupport.....	40		40
Attempting to obtain free ride on railroad train.....	1		1	Obscene and indecent language.....	16	1	17
Attempt to commit rape.....	3		3	Obtaining money by false pretenses.....	5		5
Battery.....	87	8	95	Obtaining property by false pretenses.....	2		2
Bringing stolen property into the Canal Zone.....	9		9	Perjury.....	4		4
Burglary.....	56	3	59	Petit larceny.....	335	14	349
Carrying concealed weapons.....	29	1	30	Practicing midwifery without license.....		1	1
Causing false arrest.....	5		5	Rape.....	3		3
Circulating obscene literature.....	2		2	Receiving stolen property.....	1		1
Civil order of arrest.....	1		1	Returning to the Canal Zone after being deported therefrom.....	1		1
Contempt of court.....	46	6	54	Robbery.....	4		4
Crime against nature.....	1		1	Threats.....	1		1
Criminal negligence.....	1		1	Trespass.....	54	2	56
Cruelty to animals.....	78		78	Unlawful assembly.....	2		2
Cruelty to children.....	1	1	2	Unlawful possession of firearms.....	18		18
Defilement.....	2		2	Vagrancy.....	303	7	310
Desertion from merchant ship.....	9		9	Violating automobile regulations.....	2		2
Desertion from United States Marine Corps.....	14		14	Violating building regulations.....	13	1	14
Detained for investigation.....	13		13	Violating coach tariff regulations.....	6		6
Detained as witness.....	1		1	Violating license regulations.....	35	1	36
Disorderly conduct.....	1,049	128	1,177	Violating liquor regulations.....	22	4	26
Disturbing the peace.....	666	124	790	Violating lottery laws.....	3		3
Embezzlement.....	65	6	61	Violating navigation regulations.....	2		2
Escaping from jail.....	1		1	Violating postal regulations.....	1		1
Exhibiting weapon in a threatening manner.....	1		1	Violating quarantine regulations.....	5		5
Extradition.....	12		12	Violating revenue laws.....	19	2	21
False personation.....	56	3	59	Violating sanitary regulations.....	224	11	235
Fighting.....	18		18	Violating tax regulations.....	5		5
Forgery.....	142		142	Violating water regulations.....		1	1
Fraud.....	14		14				
Gambling.....	68		68				
Grand larceny.....	1		1				
Incorrigibility.....	14		14				
Indecent exposure.....	10	7	23				
Insanity.....	2		2				
Interfering with an officer.....	428	3	431				
Intoxication.....	462	11	473				
Intoxication and disorderly.....							
				Total.....	5,500	459	5,959

TABLE 22.—*Nationality of persons arrested during fiscal year ended June 30, 1911.*

Arabia.....	1	Great Britain—Continued.	
Austria.....	4	British West Indies—Continued.	
Belgium.....	1	New Providence.....	17
Bolivia.....	1	St. Kitts.....	26
Brazil.....	1	St. Lucia.....	114
Chile.....	39	St. Vincent.....	33
China.....	53	Trinidad.....	144
Colombia.....	252	Turk Island.....	6
Costa Rica.....	17	Greece.....	90
Cuba.....	20	Guatemala.....	3
Denmark.....	14	Hayti.....	21
St. Thomas.....	4	Holland.....	2
Ecuador.....	8	Dutch Guiana.....	2
Egypt.....	4	Honduras.....	4
France.....	29	Italy.....	92
Guadeloupe.....	88	Mexico.....	29
Martinique.....	315	Nicaragua.....	18
French Guiana.....	4	Norway.....	27
Germany.....	34	Panama.....	369
Great Britain:		Peru.....	45
Australia.....	4	Portugal.....	12
British East Indies.....	20	Russia.....	13
British Guiana.....	36	Finland.....	11
British South Africa.....	2	San Salvador.....	5
Canada.....	7	Santo Domingo.....	2
England.....	43	Spain.....	531
Ireland.....	32	Sweden.....	13
Scotland.....	12	Switzerland.....	3
British West Indies—		Turkey.....	4
Antigua.....	135	Syria.....	9
Barbados.....	1,487	United States.....	436
Bermuda.....	5	Hawaii.....	1
Dominica.....	14	Porto Rico.....	5
Fortune Island.....	69	Venezuela.....	11
Grenada.....	69		
Jamaica.....	1,101	Total.....	5,950
Montserrat.....	26		

TABLE 23.—*Arrests, by stations, during the fiscal year ended June 30, 1911.*

	1910						1911						Total
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Ancon.....	40	27	27	18	25	40	28	52	32	56	58	52	455
Balboa.....	47	58	25	31	19	42	28	25	18	32	20	25	370
Las Sabanas.....	2			4		1		1					9
Corozal.....	12	2	4	6	11	7	2	6	4	16	6	8	84
Miraflores.....	9	14	11	12	5	9	4	9	5	21	24	26	149
Pedro Miguel.....	39	40	45	24	17	23	16	12	26	26	22	20	310
Empire.....	81	89	53	52	49	59	29	57	54	34	66	54	677
Paraiso.....	22	20	13	11	14	17	7	29	6	10	6	16	171
Culebra.....	28	36	29	23	32	27	27	25	30	22	24	23	326
Las Cascadas.....	18	30	15	23	13	21	12	7	10	3	13	6	171
Gorgona.....	42	37	42	42	42	40	39	47	48	49	43	45	516
Bas Obispo.....	10	11	3	4	12	12	7	16	13	22	11	13	134
Matachin.....	10	11	17	8	7	11	10	9	14	7	10	9	123
San Pablo.....	25	20	13	17	15	13	2	9	4	4	4	1	127
Tabernilla.....	20	11	14	11	21	15	7	8	5	8	4	9	133
Frijoles.....			1	1		1		2					5
Cristobal.....	79	91	75	93	69	70	59	36	73	76	66	85	872
Bohio.....	5	11	5	9	4	3	7	7	1	7	4	2	65
Gatun.....	56	76	90	61	83	98	67	105	68	104	61	48	917
Monte Lirio.....	2		2	5	2	2			1	1	1	2	18
Mount Hope.....	3	14	3	3	10	3	10	2	10	7	19	7	91
Toro Point.....	3	5	10	3	9	18	15	13	12	9	4	8	109
Porto Bello.....	19	15	3	13	12	13	8	9	7	12	3	13	127
Total.....	572	618	500	474	471	545	384	486	442	526	469	472	5,950

TABLE 24.—Occupations of persons arrested during the fiscal year ended June 30, 1911.

Agents.....	4	Messboys.....	4
Attendants.....	2	Messengers.....	9
Attorney.....	1	Midwife.....	1
Bakers.....	23	Millwrights.....	3
Barbers.....	12	Molders.....	9
Bartenders.....	10	Musicians.....	4
Bell boy.....	1	No occupation.....	298
Blacksmiths.....	27	Nurse.....	1
Block operator.....	1	Office boy.....	1
Boatmen.....	4	Oilers.....	13
Boilermakers.....	43	Orderlies.....	3
Boilermaker helper.....	1	Painters.....	24
Bootblacks.....	2	Pantryman.....	1
Brakemen.....	158	Pattern maker.....	1
Bricklayer.....	1	Peddlers.....	54
Bridgemen.....	3	Pharmacist.....	1
Butchers.....	21	Photographers.....	3
Cab drivers.....	97	Physicians.....	3
Cable splicers.....	3	Pipefitters.....	10
Cigar maker.....	1	Pitman.....	1
Carpenters.....	90	Plumbers.....	4
Car repairers.....	7	Police men.....	7
Chauffeurs.....	5	Porter.....	1
Checkers.....	8	Postmaster.....	1
Clerks.....	58	Powdermen.....	6
Coal passers.....	3	Printer.....	1
Collectors.....	2	Prostitutes.....	3
Conductors.....	7	Quartermasters.....	2
Cooks.....	35	Real-estate operators.....	4
Coppersmiths.....	3	Restaurant keepers.....	26
Cranemen.....	11	Reporter.....	1
Dairymen.....	2	Riggers.....	5
Dentist.....	1	Rodman.....	1
Dishwashers.....	2	Saddlers.....	2
Domestics.....	383	Sailors.....	219
Dredgeman.....	1	Sail trimmer.....	1
Dressmakers.....	2	Salesmen.....	5
Drillmen.....	6	Saloon keepers.....	5
Electricians.....	9	School teachers.....	2
Engineers.....	44	Servants.....	4
Errand boy.....	1	Shlp's officers.....	4
Farmers.....	193	Shoemakers.....	15
Firemen.....	122	Soldier.....	1
Fishermen.....	9	Steamfitters.....	3
Flagmen.....	9	Stenographers.....	3
Foremen.....	100	Stevedore.....	1
Gardeners.....	3	Stewards.....	7
Hostlers.....	11	Stonecutter.....	1
Hotel keepers.....	2	Superintendent.....	1
Inspectors.....	6	Switchmen.....	35
Iron workers.....	6	Tailors.....	41
Janitors.....	38	Teamsters.....	50
Jewelers.....	4	Telephone operators.....	2
Laborers.....	3, 127	Timekeepers.....	10
Laundresses.....	41	Trackman.....	1
Laundrymen.....	3	Trainman.....	1
Lighthouse tender.....	1	Waiters.....	31
Lineman.....	1	Waitress.....	1
Lumberman.....	1	Washerwomen.....	3
Machinists.....	50	Watchmen.....	28
Machinists' helpers.....	21	Water boys.....	22
Marines.....	11	Winchmen.....	3
Masons.....	9		
Merchants.....	87	Total.....	5,959

TABLE 25.—Crimes committed by prisoners confined in the penitentiary June 30, 1911.

Assault with deadly weapon.....	20	Manslaughter.....	6
Assault with intent to kill.....	1	Voluntary.....	2
Bringing stolen property into Canal Zone.....	2	Involuntary.....	1
Burglary:		Murder:	
First degree.....	10	First degree.....	3
Second degree.....	32	Second degree.....	3
Attempt to commit.....	1	Assault with attempt to commit.....	2
Cheats.....	2	Perjury.....	2
Crime against nature.....	2	Rape.....	4
Crime against nature, attempt to commit.....	1	Rape, assault with attempt to commit.....	1
Criminal negligence.....	1	Receiving stolen property.....	1
Embezzlement.....	6		
False personation.....	1	Total.....	148
Forgery.....	6		
Larceny:			
Grand.....	37		
Petit.....	1		

TABLE 26.—Occupations of prisoners confined in penitentiary June 30, 1911.

Agent (freight).....	1	Laborers.....	83
Baker.....	1	Masons.....	2
Blacksmiths.....	2	Musician.....	1
Boiler maker.....	1	No occupation.....	3
Brakemen.....	4	Other.....	1
Carpenters.....	5	Painter.....	1
Clerks.....	2	Pipe fitters.....	3
Coachmen.....	3	Quartermaster.....	1
Cooks.....	3	Restaurant keeper.....	1
Distiller.....	1	Sailors.....	3
Drill men.....	4	Steam fitter.....	1
Farmers.....	7	Stevadore.....	1
Firemen.....	4	Steward.....	1
Foreman.....	1	Switchman.....	1
Gardener.....	1	Teamster.....	1
Hostler.....	1	Walter.....	1
Ironworker.....	1		
Janitor.....	1	Total.....	148

TABLE 27.—Nationality of persons confined in the penitentiary June 30, 1911.

Chile.....	5	Great Britain—Continued.	
Colombia.....	4	West Indies—Continued.	
Costa Rica.....	1	Montserrat.....	1
Cuba.....	1	New Providence.....	1
Denmark: St. Thomas.....	1	St. Lucia.....	1
France:		Trinidad.....	4
French Guiana.....	1	Greece.....	3
Guadeloupe.....	2	Italy.....	2
Martinique.....	11	Nicaragua.....	2
Great Britain:		Panama.....	17
Ireland.....	1	Peru.....	1
West Indies—		Spain.....	12
Antigua.....	1	Turkey.....	1
Barbados.....	37	United States.....	13
Bermudas.....	1	Porto Rico.....	1
Grenada.....	1		
Jamaica.....	22	Total.....	148

TABLE 28.—Ages of prisoners confined in penitentiary June 30, 1911.

Ages.	Black.	White.	White American.	Total.
15 to 30 years.....	72	32	2	106
30 to 40 years.....	19	7	7	33
40 to 50 years.....	2	3	2	7
50 to 60 years.....	1	1		2
Total.....	94	43	11	148

Age of youngest prisoner.....	years..	15
Age of oldest prisoner.....	do.....	60
Able to read and write.....		102
Unable to read or write.....		46

TABLE 29.—Causes of deaths investigated by the coroner during fiscal year ended June 30, 1911.

Asphyxiation.....	1	Natural causes.....	1
Burns.....	1	Neuralgia of the heart.....	1
Drowning, accidental.....	30	Railroad accident.....	51
Dynamite explosion.....	4	Shot, accidentally.....	1
Electrocution, accidental.....	8	Suffocation.....	3
Epilepsy.....	1	Traumatism, accidental.....	35
Hemorrhage.....	2		
Homicide.....	10	Total.....	150
Ill-defined.....	1		

TABLE 30.—*Nationality of persons whose deaths were investigated by the coroner during the fiscal year ended June 30, 1911.*

Bulgaria.....	1	Greece.....	5
China.....	1	Italy.....	5
Colombia.....	4	Nicaragua.....	2
France:		Norway.....	2
Guadeloupe.....	8	Panama.....	12
Martinique.....	7	Peru.....	1
Great Britain:		Spain.....	16
British West Africa.....	1	United States.....	15
British West Indies:		Venezuela.....	1
Antigua.....	4	Unknown.....	2
Barbados.....	30		
Fortune Island.....	1	Total.....	150
Grenada.....	1		
Jamaica.....	23		
Montserrat.....	2		
St. Lucia.....	4		
St. Vincent.....	2		

TABLE 31.—*Statement of accidents involving personal injuries investigated during the fiscal year ended June 30, 1911.*

Bulgaria.....	1	Great Britain—Continued.	
Chile.....	1	British West Indies—Continued.	
China.....	2	New Providence.....	1
Colombia.....	18	Nevis.....	2
Costa Rica.....	1	St. Kitts.....	1
Denmark:		St. Lucia.....	9
St. Thomas.....	1	St. Vincent.....	9
Ecuador.....	2	Trinidad.....	11
France:		British Guiana.....	1
Guadeloupe.....	11	Greece.....	18
Martinique.....	26	Haiti.....	2
St. Martin.....	1	Italy.....	17
Great Britain:		Mexico.....	2
British West Africa.....	2	Nicaragua.....	5
England.....	1	Norway.....	4
British West Indies—		Panama.....	37
Antigua.....	12	Peru.....	3
Barbados.....	135	Portugal.....	1
Dominica.....	1	Spain.....	77
Fortune Island.....	3	United States.....	95
Grenada.....	10		
Jamaica.....	134	Total.....	662
Montserrat.....	5		

Of the above cases, 481 were Isthmian Canal Commission employees, 93 Panama R. R. Co. employees, and 88 nonemployees.

## APPENDIX III.—DIVISION OF PUBLIC WORKS.

TABLE 32.—*Consumption of water, collections made, and bills outstanding for water rents in the city of Panama for fiscal year ended June 30, 1911.*

[Estimated population, 46,214; 154 fire hydrants.]

Quarter ending—	Paying connections.	Consumption per quarter.			Daily average consumption.
		Private.	Public hydrants and taps.	Total.	
		<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>
Sept. 30, 1910.....	1,557	71,030,250	31,213,069	102,243,319	1,111,340
Dec. 31, 1910.....	1,654	63,157,500	40,424,984	103,582,484	1,125,896
Mar. 31, 1911.....	1,715	80,009,700	30,110,577	110,120,277	1,223,558
June 30, 1911.....	1,762	82,400,250	37,390,390	119,790,640	1,316,350
Total for year.....		296,597,700	139,139,020	435,736,720	1,194,293



TABLE 32.—*Consumption of water, collections made, and bills outstanding for fiscal year ended June 30, 1911—Continued.*

Quarter ending—	Amount collected from private consumers.	Amount paid or to be paid by Panama Government.	Total revenue as per agreement.	Average consumption per private connection per quarter.	Average private quarterly bill.	Cost per hydrant per quarter.
				<i>Gallons.</i>		
Sept. 30, 1910.....	\$17,841.80	\$2,816.11	\$20,657.91	45,620	\$11.46	\$18.29
Dec. 31, 1910.....	18,967.05	1,223.56	20,190.61	36,184	11.49	7.94
Mar. 31, 1911.....	20,584.60	276.39	21,160.99	46,652	12.20	1.79
June 30, 1911.....	20,913.00		20,913.00	46,765	11.87	.....
Total for year.....	78,606.45	4,316.06	82,922.51	177,221	47.02	28.02

1 Net amount of bills.

TABLE 33.—*Consumption of water, collections made, and bills outstanding for water rents in the city of Colon for the fiscal year ended June 30, 1911.*

[Estimated population, 19,801; 84 hydrants.]

Quarter ending—	Paying connections, not including Panama R. R. or Isthmian Canal Commission.	Consumption per quarter.					Average daily consumption.
		Private consumers.	Panama R. R. reservation.	Isthmian Canal Commission hospital and quarantine station.	Public hydrants and taps.	Total.	
		<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>
Sept. 30, 1910.....	551	38,197,742	7,427,160	5,019,585	28,989,239	79,633,726	855,584
Dec. 31, 1910.....	563	38,330,562	6,106,135	4,324,245	43,781,933	92,541,875	1,005,690
Mar. 31, 1911.....	573	37,319,389	8,821,230	4,407,760	38,538,931	89,137,300	990,414
June 30, 1911.....	551	36,750,900	8,121,000	4,230,760	31,758,595	80,861,245	888,585
Total for year.....		150,648,593	30,474,525	17,982,330	143,068,698	342,174,146	937,618

Quarter ending—	Amount collected from private consumers.	Amount collected from Panama R. R. Co.	Amount collected from Isthmian Canal Commission.	Excess of collections over amount guaranteed by Panama Government.	Total revenue per quarter.	Average consumption per private connection per quarter.	Average private quarterly bill.	Cost per hydrant and public tap per quarter.
						<i>Gallons.</i>		
Sept. 30, 1910.....	\$15,044.20	\$2,228.40	\$1,506.00	.....	\$18,778.60	69,324	\$27.30	Free.
Dec. 31, 1910.....	15,498.00	1,831.20	1,297.20	\$1,226.80	19,853.20	68,082	27.53	\$14.60
Mar. 31, 1911.....	13,938.45	2,646.30	2,513.70	88.55	19,187.00	65,217	24.41	1.06
June 30, 1911.....	14,908.70	2,436.30	1,269.30	1,433.48	18,614.30	66,696	27.02	.....
Total for year.....	59,389.35	9,142.20	6,586.20	2,748.83	76,433.10	269,321	106.30	15.65

1 Net amount of bills.

## APPENDIX IV.—DIVISION OF SCHOOLS.

TABLE 34.—*Monthly enrollment and average daily attendance.*

	White schools.		Colored schools.	
	Monthly enrollment.	Average daily attendance.	Monthly enrollment.	Average daily attendance.
<b>1910.</b>				
October.....	931	802.0	906	611.0
November.....	978	865.0	918	595.0
December.....	1,023	856.0	893	528.0
<b>1911.</b>				
January.....	1,157	863.8	1,276	626.6
February.....	1,283	914.2	1,360	611.9
March.....	1,305	864.6	1,488	658.2
April.....	1,330	840.1	1,536	508.1
May.....	1,373	792.3	1,543	471.5
June.....	1,410	751.0	1,568	394.9

TABLE 35.—*Total enrollment for the year, by schools.*

<b>White schools:</b>		<b>White schools—Continued.</b>	
Ancon School.....	252	Cristobal.....	200
Pedro Miguel.....	42		
Paraiso.....	47	Total.....	1,410
Culebra.....	130	Total for all colored schools.....	1,568
Empire.....	209		
Bas Obispo.....	26	Total gross enrollment.....	2,978
Gorgona.....	159	Transferred from other Zone schools.....	347
Tabernilla.....	32		
Gatun.....	193	Total net enrollment.....	2,631

TABLE 36.—*Enrollment, by grades.*

	White.	Colored.	Total.
Grade I.....	320	779	1,099
Grade II.....	241	354	595
Grade III.....	176	274	450
Grade IV.....	180	126	306
Grade V.....	143	35	178
Grade VI.....	107		107
Grade VII.....	85		85
Grade VIII.....	93		93
Grade IX.....	32		32
Grade X.....	22		22
Grade XI.....	9		9
Grade XII.....	2		2
<b>Total.....</b>	<b>1,410</b>	<b>1,568</b>	<b>2,978</b>

TABLE 37.—*Number of teachers employed.*<sup>1</sup>

	White.	Colored.	Total.
1910.			
October.....	37	24	61
November.....	36	24	60
December.....	38	24	62
1911.			
January.....	40	24	64
February.....	42	24	66
March.....	42	25	67
April.....	42	25	67
May.....	43	24	67
June.....	43	24	67

<sup>1</sup> All teachers in white schools are American women, except the principal and teacher of physics in the Gatun High School, who are men. All teachers in the colored schools are colored men.

*Sickness of teachers.*

	White.	Colored.	Total.
1910.			
October.....	3.5		3.5
November.....	22.0		22.0
December.....	26.0		26.0
1911.			
January.....	38.0		38.0
February.....	14.5		14.5
March.....	47.5	4.0	51.5
April.....	33.0	3.0	36.0
May.....	53.0		53.0
June.....	36.0	7.0	43.0
Total.....	273.5	14.0	287.5

TABLE 38.—*Value of products raised in school gardens.*

	Unit.	Quantity.	Price.	Proceeds.
Radishes.....	Bunches.....	800	<i>Cents.</i> 10	\$90.00
Lettuce.....	do.....	270	10	27.00
Peas.....	Pounds.....	320	10	32.00
Mustard.....	.....			15.00
Beans.....	Pounds.....	910	15	136.50
Tomatoes.....	do.....	2,175	10	217.50
Cucumbers.....	do.....	165	10	16.50
Okra.....	Dozens.....	1,590	10	159.00
Watermelons.....	Pounds.....	50	5	2.50
Eggplants.....	do.....	40	5	2.00
Cabbage.....	do.....	1,060	3	31.80
Turnips.....	do.....	20	5	1.00
Peppers.....	Dozens.....	50	10	5.00
Onions.....	Bunches.....	83	5	4.15
Bananas.....	do.....	212	30	63.60
Total.....				783.55

<sup>1</sup> Estimated.

## APPENDIX V.—CANAL ZONE FUNDS.

TABLE 39.—Revenues collected from July 1, 1910, to June 30, 1911.

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
Aerated waters.....	\$850.00	\$2,190.40	\$1,778.40	\$1,390.00	\$6,208.80
Animal licenses.....	53.40	229.60	191.70	111.00	565.70
Auctioneers.....		4.00	2.00	21.00	27.00
Bowling alleys.....		15.00			15.00
Building rentals.....	2,123.26	1,758.00	600.00		4,481.26
Burial permits.....	453.12	453.12	453.13	453.13	1,812.50
Cabs and coaches.....		70.50	8.25	6.50	85.25
Carts.....	134.40	577.20	133.10	1,344.00	2,188.80
Circuit-court collections.....	1,750.34	1,750.34	1,750.36	1,750.36	7,001.40
Dance halls.....	20.00	70.00	20.00	50.00	160.00
Distilling licenses.....	309.88		2,124.32	110.78	2,544.98
District-court collections.....	6,834.30	5,249.15	4,274.49	6,001.25	22,449.19
Escheated estates.....	389.56	389.57	389.57	389.57	1,558.27
Gathering coconuts.....				108.75	108.75
Hucksters.....				90.80	90.80
Hunting permits.....	491.25	491.25	491.25	491.25	1,965.00
Insurance taxes.....	128.15	128.15	128.15	128.15	512.59
Interest.....	6,940.85	6,940.85	6,940.85	6,940.85	27,763.40
Land rentals.....	3,142.63	7,359.79	6,753.18	1,865.20	19,120.80
Market rentals.....	414.60	2,904.78	1,106.20	614.00	5,039.58
Marshals' fees.....	424.49	424.48	424.48	424.49	1,697.94
Merchandise and drugs.....	1,064.20	4,025.20	2,988.60	2,019.20	10,095.20
Motor-vehicle licenses.....	264.50	264.50	264.50	264.50	1,058.00
Peddling.....	1,339.00	3,163.50	1,510.00	2,872.50	8,885.00
Physicians' licenses.....	23.75	23.75	23.75	23.75	95.00
Police fines.....	83.23	83.23	83.23	83.23	332.92
Poll taxes.....	174.00	502.00	118.00	375.60	1,169.60
Found fees.....	39.15	240.80	99.80	151.65	531.40
Public entertainments.....	27.00	322.00	83.10	87.00	519.10
Real-estate taxes.....	4,014.30	15,320.67	10,969.90	10,802.74	41,108.61
Restaurants.....	194.80	514.80	311.30	159.80	1,181.20
Retail liquor licenses.....		50,400.00	27,600.00	19,200.00	97,200.00
Retail sale of tobacco.....	909.60	3,282.80	2,318.40	1,953.20	8,474.00
Sale imported meats.....	160.90	39.79	2.10	113.12	315.91
Sale impounded animals.....	.40	14.00		10.00	24.40
Sale property.....	3,003.10	2,503.10	3.10	3.10	5,512.40
School tuition, lost or damaged books.....	193.57	193.57	193.57	193.57	774.28
Services district prisoners.....	6.40				6.40
Slaughter taxes.....	102.00	13,781.00	3,371.50	380.00	17,634.50
Water taxes.....	1,360.35	8,187.85	4,391.55	6,591.95	20,531.70
<b>Total.....</b>	<b>37,420.48</b>	<b>133,874.84</b>	<b>81,920.33</b>	<b>67,675.98</b>	<b>320,891.63</b>
Sale of postage stamps.....					82,613.72
Money-order fees.....					23,457.98
<b>Total.....</b>					<b>426,963.33</b>

TABLE 40.—*Expenditures from July 1, 1910, to June 30, 1911.*

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
<i>Public improvements.</i>					
Roads and trails:					
Construction.....	\$24,269.26	1,886.07	\$5,963.98	\$4,541.37	\$34,588.54
Maintenance.....	1,078.11	7,045.47	476.63	6,708.31	15,302.52
Market houses:					
Construction.....		110.64			110.64
Maintenance.....	23.43	303.58	147.94	56.94	532.89
Operation.....	384.00	411.00	432.90	382.56	1,610.46
Slaughterhouses:					
Construction.....		776.88			776.88
Maintenance.....		379.83	14.10		393.93
Operation.....	375.00	375.00	375.00	375.00	1,500.00
Waterworks and sewers:					
Construction.....	121.60	005.30	59.16	1,417.48	2,203.54
Maintenance.....	7.50	388.24	113.13	173.99	682.86
Street lighting.....	79.02	321.72	460.23	174.65	1,035.62
Maintenance miscellaneous public works.....	30.00	298.00	2.27		330.27
<i>Public schools.</i>					
Schoolhouses:					
Construction.....	4,268.54	3,713.32	135.72	4,965.28	13,082.86
Maintenance.....	646.06	578.06	253.33	828.12	2,305.56
Salaries, superintendent, teachers, and clerks.....	13,957.02	13,957.07	13,957.06	13,957.04	55,828.19
Janitor service.....	310.95	665.35	409.18	545.28	1,930.76
Furniture and equipment.....	321.37	516.22	161.44	536.23	1,535.26
Supplies.....	1,428.55	1,612.40	1,466.50	1,582.83	6,090.28
Traveling and miscellaneous expenses.....	889.15	565.03	42.06	701.31	2,197.55
<i>Maintenance administrative districts.</i>					
Salaries tax collectors.....	1,009.58	1,009.57	1,009.59	1,009.58	4,038.32
Salaries district judges.....	4,384.55	4,384.54	4,384.53	4,384.54	17,538.16
Supplies and miscellaneous.....	177.82	410.60	312.01	127.47	1,027.90
Maintenance Zone charity cases.....	900.00	900.00	900.00	900.00	3,600.00
Maintenance district prisoners.....	2,901.54	2,806.33	4,015.13	1,868.32	11,591.32
Total.....	57,564.05	42,048.07	34,990.89	45,231.30	179,834.31
<i>Contingent expenses.</i>					
Gratuity penitentiary prisoners.....					667.50
Miscellaneous.....					285.15
<i>Postal service.</i>					
Purchase of stamps.....					28,075.00
Transportation of mails:					
Isthmus.....					12,760.00
Ocean.....					10,782.56
Miscellaneous expenses.....					7,506.03
Transfer to Isthmian Canal Commission as reimbursement in part for salaries paid.....					40,000.00
Total.....					280,013.15

<sup>1</sup> Credit for work done for Las Cascadas estates.TABLE 41.—*Statement of balances in the Canal Zone Treasury on June 30, 1911.*

Public improvements and schools.....	\$43.27
1908.....	4,448.73
1909.....	15.75
1910.....	24,731.53
1911.....	127,030.28
Miscellaneous and contingent.....	743.25
1908.....	3,780.15
1909.....	1,181.70
1910.....	7,913.36
1911.....	9,082.65
Postal service:	
1910.....	7,676.22
1911.....	10,560.70
	197,207.50

In accordance with the sundry civil appropriation act dated March 4, 1911, the Treasurer will take up the following balances July 1, 1911:

Public improvements and schools.....	\$168,971.40
Miscellaneous and contingent.....	10,000.00
Postal service:	
1910.....	7,676.22
1911.....	10,559.97
	<u>197,207.59</u>

APPENDIX VI.—BUSINESS TRANSACTED IN THE COURTS OF THE CANAL ZONE DURING THE FISCAL YEAR ENDED JUNE 30, 1911.

TABLE 42.—*Supreme Court.*

	Criminal cases.	Civil cases.		Criminal cases.	Civil cases.
Pending July 1, 1910.....	11	6	Withdrawn.....		
Filed during year.....	7	9	Dismissed.....		
Affirmed.....	3	3	Habeas corpus proceeding.....		
Reversed.....	2	8	Pending June 30, 1911.....	3	4

<sup>1</sup> Report for fiscal year 1909-10 is in error in showing no cases pending on June 30, 1910; 1 criminal case pending on that date should have been shown.

Number of sessions of court.....	16
Number of attorneys admitted.....	5

TABLE 43.—*First circuit court.*

CRIMINAL CASES.

Months.	Cases filed.	Convicted.	Acquitted.	Dismissed.	Collections.		
					Fines.	Costs.	Total.
1910.							
Cases pending July 1.....	<sup>1</sup> 5						
July.....	9	5	2		\$60.00	\$23.40	\$83.40
August.....	8	11	1	1	74.00	2.10	76.10
September.....	4	3	2				
October.....	4	3	1		10.00	3.75	13.75
November.....	7	3			20.00	11.45	31.45
December.....	14	9	2				
1911.							
January.....	2	8		2	25.00	10.30	35.30
February.....	7	2		1	25.00	4.70	29.70
March.....	7	3	3				
April.....	7	5	1	1	20.00	7.20	27.20
May.....	10	11	2		100.00	28.00	128.00
June.....	2	3	1		10.00		10.00
Total.....	86	66	15	5	344.00	90.90	434.90

<sup>1</sup> Annual report for fiscal year 1909-10 shows 6 criminal cases pending on June 30, 1910. It should be 5. Cases pending June 30, 1911, none.

CIVIL CASES.

Cases pending July 1, 1910.....	1
Cases filed.....	31
Cases settled.....	21
Cases pending June 30, 1911.....	<sup>1</sup> 11
Costs.....	\$232.00
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$714.00

<sup>1</sup> Including probate cases.

• TABLE 44.—*Second circuit court.*  
CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Dis- missed.	Collections.			
					Fines.	Costs.	Total.	
1910.								
Cases pending July 1.....	1 16							
July.....	19	19	3		\$308.75	\$93.70	\$402.45	
August.....	13	9	2	8	520.00	41.15	\$ 561.15	
September.....	15	5	4		200.00	2.40	\$ 202.40	
October.....	17	12	2	2	52.50	33.75	86.25	
November.....	12	12	2	2	230.00	33.75	263.75	
December.....	11	1	5	3				
1911.								
January.....	25	19	1	8	180.00	25.45	\$ 205.45	
February.....	16	7	5	2		1.50	1.50	
March.....	24	10	7		15.00	18.25	33.25	
April.....	16	15	8	2	80.00	36.35	116.35	
May.....	19	13	2	3	10.00	2.25	12.25	
June.....	14	8	3		90.00	19.05	109.05	
Total.....	217	130	44	30	1,686.25	307.60	1,993.85	

<sup>1</sup> Annual report for fiscal year 1909-10 shows 15 criminal cases pending on June 30, 1910. It should be 16.

<sup>2</sup> Includes 2 cases of change of venue.

<sup>3</sup> Includes forfeitures of \$810.

<sup>4</sup> Includes 3 cases remanded.

Cases pending June 30, 1911, 13.

#### CIVIL CASES.

Cases pending July 1, 1910.....	1 41
Cases filed.....	111
Cases settled.....	99
Cases pending June 30, 1911.....	1 33
Costs.....	\$1,003.50
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$1,064.90

<sup>1</sup> Including probate cases.

TABLE 45.—*Third circuit court.*  
CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Dis- missed.	Collections.		
					Fines.	Costs.	Total.
1910.							
Cases pending July 1.....	5						
July.....	6	6	1			\$8.00	\$8.00
August.....	2	3		1			
September.....	9	3	5				
October.....	9	5	3	1	\$10.00	5.00	15.00
November.....	8	3	1				
December.....	3	2	1	2	40.00	8.00	48.00
1911.							
January.....		1	3				
February.....		1					
March.....	4		1	1			
April.....	10	6			28.00	10.00	38.00
May.....	5	3	1	1	30.00	12.00	42.00
June.....	10	5	3	2	25.00	8.00	33.00
Total.....	71	38	19	8	131.00	51.00	182.00

Cases pending June 30, 1911, 6.

#### CIVIL CASES.

Cases pending July 1, 1910.....	1 40
Cases filed.....	106
Cases settled.....	111
Cases pending June 30, 1911.....	1 44
Costs.....	\$304.00
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$1,232.60

<sup>1</sup> Including probate cases. Annual report for fiscal year 1909-10 shows 54 civil cases pending June 30, 1910. It should be 49.

<sup>2</sup> Including probate cases.

TABLE 46.—*District court, district of Ancon.*

## CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1910.								
Pending July 1 ..	14							
July.....	140	123	8	5		\$728. 00	\$103. 69	\$831. 69
August.....	146	130	11	4	7	741. 00	3. 45	744. 45
September.....	113	80	21	4	8	647. 00		647. 00
October.....	90	69	19	3		293. 00		293. 00
November.....	65	43	12	6	2	247. 00		247. 00
December.....	118	93	20	3	3	595. 50		595. 50
1911.								
January.....	68	55	11	1	1	474. 00		474. 00
February.....	95	77	13	5		440. 50		440. 50
March.....	82	68	7	6		438. 00		438. 00
April.....	146	127	11	3	3	883. 50	6. 60	890. 10
May.....	127	105	6	9	4	526. 00		526. 00
June.....	127	109	17	2	1	456. 00		456. 00
Total.....	1,321	1,079	156	51	29	6,519. 50	113. 74	6,633. 24

1 Annual report for fiscal year 1909-10 shows 3 criminal cases pending on June 30, 1910; should be 4.

Forfeitures, \$35.

Cases pending June 30, 1911, 3.

## CIVIL CASES.

Cases pending July 1, 1910.....	13
Cases filed.....	142
Cases settled.....	143
Cases pending June 30, 1911.....	12
Costs.....	\$171. 86
Miscellaneous.....	\$2. 00

TABLE 47.—*District court, district of Empire.*

## CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections. .		
						Fines.	Costs.	Total.
1910.								
Pending July 1.....	3							
July.....	146	125	10	4	9	\$521. 50	\$98. 50	\$620. 00
August.....	173	146	11	10	6	558. 50	6. 30	564. 80
September.....	105	81	19	6		375. 00	11. 10	386. 10
October.....	104	81	11	11	1	351. 50	9. 45	360. 95
November.....	163	68	20	9	6	382. 00	10. 15	392. 15
December.....	124	94	11	7	6	332. 50	17. 50	350. 00
1911.								
January.....	83	59	13	10	6	365. 50	19. 15	384. 65
February.....	117	83	11	9	13	317. 50		317. 50
March.....	100	71	13	10	3	363. 50		363. 50
April.....	65	48	8	8		184. 50		184. 50
May.....	118	89	16	7	1	364. 00	5. 00	369. 00
June.....	101	73	22	9	3	407. 00	2. 50	409. 50
Total.....	1,342	1,018	170	100	54	4,523. 00	179. 65	4,702. 65

Forfeitures, \$175.

Cases pending June 30, 1911, none.

## CIVIL CASES.

Cases pending July 1, 1910.....	18
Cases filed.....	267
Cases settled.....	274
Cases pending June 30, 1911.....	11
Costs.....	\$364. 15
Notarial fees.....	\$4. 70



TABLE 48.—*District court, district of Gorgona.*

## CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Committ- ed to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1910.								
Pending July 1.....								
July.....	110	78	19	9	3	\$375.00	\$41.50	\$416.50
August.....	92	69	13	6	4	250.00	6.50	256.50
September.....	94	60	23	8	4	313.00		313.00
October.....	89	57	22	4	6	340.00		340.00
November.....	94	64	17	9	4	355.00		355.00
December.....	104	72	14	10	8	414.00		414.00
1911.								
January.....	70	53	10	4	3	238.00		238.00
February.....	101	60	18	7	7	377.50		377.50
March.....	90	65	8	14	3	350.50		350.50
April.....	96	69	19	6	2	318.00		318.00
May.....	73	50	10	8	3	292.00		292.00
June.....	83	59	15	7	4	360.00		360.00
Total.....	1,096	765	188	92	31	3,983.00	48.00	4,031.00

Cases pending June 30, 1911, none.

## CIVIL CASES.

Cases pending July 1, 1910.....	9
Cases filed.....	248
Cases settled.....	254
Cases pending June 30, 1911.....	3
Costs.....	\$315.24
Notarial fees.....	\$19.25

TABLE 49.—*District court, district of Cristobal.*

## CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1910.								
Pending July 1.....	3							
July.....	130	105	12	5	6	\$357.00	\$4.50	\$361.50
August.....	207	171	30	1	7	541.50	2.75	544.25
September.....	182	124	30	12	18	514.00		514.00
October.....	173	136	30	3	5	514.00		514.00
November.....	180	128	34	9	11	374.50		374.50
December.....	204	160	34	3	6	308.00		308.00
1911.								
January.....	162	134	22		5	370.75		370.75
February.....	163	138	20	1	5	531.00		531.00
March.....	170	128	21	4	15	508.50		508.50
April.....	192	144	20	11	9	478.50		478.50
May.....	179	120	56	3	9	584.00		584.00
June.....	158	116	24	6	13	481.00		481.00
Total.....	2,103	1,602	333	58	109	5,562.75	7.25	5,570.00

Forfeitures, \$175.

Cases pending June 30, 1911, 1.

## CIVIL CASES.

Cases pending July 1, 1910.....	23
Cases filed.....	223
Cases settled.....	247
Cases pending June 30, 1911.....	4
Costs.....	\$270.50

## APPENDIX VII.—LEGISLATIVE.

## No. 1.

## EXECUTIVE ORDER.

By virtue of the authority vested in me, I hereby establish the following Executive Order for the Canal Zone and its auxiliary lands and waters:

SECTION 1. The Isthmian Canal Commission is hereby empowered to establish rules and regulations to facilitate and protect the works of excavation, dredging and other Canal construction within the Canal Zone and the lands and waters auxiliary thereto; as well as such rules and regulations respecting the use, or passage through any of the Canal channels, lakes and other auxiliary waters as from time to time the Commission may deem needful to fully protect such channels, lakes and auxiliary waters, and to facilitate and protect the operations of Canal construction therein.

The rules and regulations that may be adopted by the Canal Commission in accordance with the provisions of this Order shall have the force and effect of law when approved by the Secretary of War.

SECTION 2. Any person violating any of the provisions of the rules and regulations established hereunder shall be guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not to exceed five hundred dollars (\$500.00), or by imprisonment in the district jail for not more than six months, or by both such fine and imprisonment, in the discretion of the court.

WM. H. TAFT.

THE WHITE HOUSE, July 25, 1910.

## No. 2.

## EXECUTIVE ORDER.

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone Government:

SECTION 1. No civil action or special proceeding shall be brought or proceeded with in the courts of the Canal Zone, in any case in which both of the parties, plaintiff and defendant, are alien non-residents of the Canal Zone, and the cause of action is one which arose without the territorial limits of the Canal Zone Government, and the party proceeded against has no property within said territorial limits, subject to the jurisdiction of the Canal Zone courts.

Neither shall any civil action or special proceeding be brought or proceeded with in the courts of the Canal Zone when both parties, plaintiff and defendant, though citizens of the United States, are found transiently within the limits of the Canal Zone Government, unless the cause of action is one arising within the said territorial limits, or the party proceeded against has property within the said limits, subject to the jurisdiction of the Canal Zone courts.

This Order shall not be construed to exclude from the jurisdiction of the Canal Zone courts cases between parties who have an official or business residence within the territorial limits of the Canal Zone Government, or who reside therein for the purpose of any occupation or employment, notwithstanding that they may not have acquired a permanent residence within said territorial limits.

SECTION 2. All laws, orders and decrees, or parts thereof, in conflict with this order, are hereby repealed.

WM. H. TAFT.

THE WHITE HOUSE, July 28, 1910.

## No. 3.

## EXECUTIVE ORDER.

*Conveyance of Real Estate by Married Women.*

By virtue of the authority vested in me I hereby establish the following Order for the Canal Zone:

Article 1. Any deed or other instrument in writing relative to or affecting real estate the separate property of a married woman, or any mortgage or other lien on such property, shall be sufficient if the husband of the married woman joins with her in the execution of the instrument and the same is acknowledged by them before an officer

authorized to take acknowledgments hereunder, in conformity with the provisions hereof.

Article 2. Any deed or other instrument in writing heretofore executed by a married woman joined by her husband and otherwise in conformity to law, conveying lands or interests therein belonging to her separate estate, or creating a mortgage or other lien thereon, shall be held to be valid and effective to pass such title to or interest in such land, or to create such mortgage or other lien thereon, from the date of the execution of the deed or other instrument, although no order may have been obtained as required by the Civil Code from a court or judge to authorize such conveyance, mortgage or other lien.

Article 3. In order to acknowledge the execution of an instrument in writing under the provisions hereof the parties shall appear in person before the officer authorized to take the same and acknowledge to him that they have executed the same for the purposes and considerations expressed in the instrument. If the parties making the acknowledgment or either of them is not personally known to the officer taking the acknowledgment, their identity must be established on the oath of a credible witness; and, in addition, the married woman making the acknowledgment must be examined privily and apart from her husband by the officer taking her acknowledgment, and the contents of the instrument in writing must be fully explained to her by him, and he shall not accept her acknowledgment unless she declares to him that she has willingly signed the instrument, without fear or compulsion on the part of her husband, and that she does not wish to retract it.

The certificate of acknowledgment of the husband shall be sufficient if it is substantially in the following form:

The ..... Judicial Circuit, Canal Zone.

Before me, ....., in and for ....., in the Canal Zone, on this day personally appeared ....., known to me (or proven to me on the oath of ....., a credible witness) to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same, for the purposes and consideration therein expressed.

Given under my hand and seal of office this ..... day of ..... A. D. ....

The certificate of acknowledgment of a married woman shall be sufficient if it is substantially in the following form:

The ..... Judicial Circuit, Canal Zone.

Before me, ....., in and for ....., in the Canal Zone, on this day personally appeared ....., known to me (or proven to me on the oath of ....., a credible witness) to be the person whose name is subscribed to the foregoing instrument, and the said ....., being examined by me privily and apart from her husband ....., and having had said instrument fully explained to her by me, acknowledged the same to be her act and deed, and declared that she had willingly signed the same for the purposes and consideration therein expressed, without fear or compulsion on the part of her husband, the said ....., and that she did not wish to retract it.

Given under my hand and seal of office this ..... day of ..... A. D. ....

Article 4. Any instrument in writing required to be acknowledged by the provisions of this Order, or by any other law or order of the Canal Zone, shall be acknowledged before a judge of any court of the Canal Zone, the clerk thereof, or before any notary public of said Canal Zone, and may also be acknowledged before the judge of any court of record or the clerk thereof or before any notary public within any state, territory, district or possession of the United States.

If the instrument is one executed in a foreign country the same may be acknowledged before any diplomatic or consular officer or commercial agent of the United States, accredited to such country.

The officers authorized to take acknowledgments hereunder are also empowered to issue proper certificates of the same.

Article 5. Articles 189 and 1810 of the Civil Code, and all laws, orders, and decrees and parts thereof, in conflict with this Order are hereby repealed; provided, however, that this Order shall not affect any deed or other instrument executed pursuant to the laws in force prior to the date upon which this Order shall take effect.

WM. H. TAFT.

THE WHITE HOUSE, August 20, 1910.

## No. 4.

## EXECUTIVE ORDER.

*Abolishing the Position of Tax Collector, Creating the Position of Deputy Collector of Revenues, and Amending the Laws Governing Taxes, etc.*

By virtue of the authority vested in me, I hereby establish the following Executive Order for the Canal Zone government:

Section 1. The office of the District Tax Collector, created by paragraph 2 of the Executive Order effective April 15, 1907, is hereby abolished.

Section 2. The duties heretofore discharged by the District Tax Collectors shall be performed by the Collector of Revenues in person or by duly appointed deputies, provided that there shall be a Deputy Collector of Revenues assigned to each administrative district, who, under the direction and supervision of the Collector of Revenues, shall exercise and perform the duties of the Collector of Revenues within the respective districts. The Collector of Revenues shall have such additional deputies, assistants, and other help, as are now assigned to him or may hereafter be assigned to him by competent authority.

The existing laws relating to the execution of official bonds by the Collector of Revenues and his deputies shall not be affected in any manner by this Order.

Section 3. Taxes and penalties assessed against real estate or the improvements thereon shall constitute a lien on such property, which shall be superior to all other liens, mortgages, or encumbrances of any kind whatsoever, and shall be enforceable against the property whether in the possession of the delinquent or any subsequent owner, and can be discharged only by the payment of the taxes, a penalty of twenty (20%) per cent, and any costs that may have accrued.

Section 4. A statement showing the persons delinquent for taxes in the respective districts, prepared and signed by the Collector of Revenues and approved by the head of the Department of Civil Administration, and containing the requisites prescribed by Section 54 of Act 7 of the Laws of the Canal Zone enacted September 1, 1904, shall be sufficient warrant for the proceedings to seize and sell property sufficient to satisfy the amount of taxes, penalties, and costs due in each case, and the moneys acquired by the Collector of Revenues at such sale shall be duly accounted for by him to the Treasurer of the Canal Zone, in like manner as other public moneys received by him; and in making returns thereof he shall show the total amount of proceeds received from such sale, the amount of taxes, penalties, and costs, and any surplus remaining that may have been paid over to the delinquent taxpayer for the payment of such surplus.

Section 5. The owner of personal property seized may redeem the same from the Collector of Revenues at any time before the sale, but not afterwards, by tendering to him or his deputy the amount of the taxes, penalties, and costs up to the time of the tender; the costs to be charged in making such seizure and sale shall only embrace the actual expense of the seizure and preservation of the property pending the sale, and no charge shall be imposed for the services of the collecting officer.

The purchaser at a tax sale of personal property shall acquire an indefeasible title to the property sold, and the officer making the sale shall execute a bill of sale of such property to the purchaser.

Section 6. The provision of said Act 7 of the Canal Zone Laws, relating to the forfeiture of real estate and other immovable property to the municipalities, formerly existing, in default of bidders at tax sales, and the procedure therein established in such cases, and the conditions therein prescribed in respect to the redemption of such property by the delinquent taxpayers, and the execution of deeds to the municipalities thereunder when the property was not duly redeemed shall apply hereafter to the Canal Zone Government, and the property shall pass to the Canal Zone government in default of bidders at such tax sales, in like manner and form as it did to the abolished municipalities under the said Act 7.

Section 7. Deeds conveying title to real estate or to improvements thereon executed by the Collector of Revenues or his deputies to private persons or to the Canal Zone government under tax sales pursuant to law, shall convey all right, title, and interest of the delinquent taxpayer in and to the property sold, on the date of such sale, and shall be entitled to registration in the real estate records of the district in which the property is situated.

Section 8. All the provisions of said Act 7 of the Canal Zone Laws relating to the levy, assessment, and payment of taxes and the enforced collection thereof which conferred powers and imposed duties on the officials of the abolished municipalities shall be held to apply to the Collector of Revenues, and, hereafter, he shall exercise and

discharge all of said powers and duties in person or through his deputies in the respective administrative districts.

Section 9. All laws, orders, or decrees in conflict with this Order are hereby repealed, but the repeal shall not affect any action or procedure that may have been taken or had under preexisting laws and such action or procedure if not terminated shall be proceeded with in conformity with this Order as near as may be; and, provided further, property now delinquent for taxes may be sold to satisfy the taxes due thereon under the provisions hereof in like manner as may be done with property becoming delinquent hereafter.

Section 10. Nothing in this Executive Order shall be held to deprive the Chairman and Chief Engineer or the head of the Department of Civil Administration from exercising any power or authority now conferred on them, or either of them, by law in relation to the appointment of officers and employees, or the supervision of the work of officers and employees responsible or reporting to them, or to either of them.

WM. H. TAFT.

THE WHITE HOUSE, October 4, 1910.

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No. 5.

EXECUTIVE ORDER.

*To Prescribe the Manner of Leasing Public Lands in the Canal Zone.*

By virtue of the authority vested in me I hereby establish the following order for the Canal Zone:

SECTION 1. The Isthmian Canal Commission is hereby authorized and empowered to establish rules and regulations, from time to time, for the leasing of public lands in the Canal Zone, in accordance with the provisions of the Act of Congress, approved February 27, 1909, and entitled: "An act relating to the use, control and ownership of lands in the Canal Zone, Isthmus of Panama."

SECTION 2. The leases for public lands authorized to be made under said Act of Congress shall be executed by the officer in charge of the Land Office of the Canal Zone Government, with the approval of the Head of the Department of Civil Administration: but the Isthmian Canal Commission, with the approval of the Secretary of War may designate some other officers to execute or approve such leases, when, in the opinion of the Commission it is necessary or convenient to do so.

WM. H. TAFT.

THE WHITE HOUSE, October 7, 1910.

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No. 6.

ORDERS.

WAR DEPARTMENT,  
Washington, January 5, 1911.

1. By direction of the President, it is ordered that the first proviso of section 1 of the order issued by the Secretary of War, by direction of the President, on December 3, 1904, which was promulgated in Circular No. 4, Isthmian Canal Commission, December 30, 1904, be amended to read as follows:

"Provided, however, That this order shall cease to be operative—

"First. If the Republic of Panama should at any time increase the rate of duty on imported articles described in class 2 of the act of the National Convention of Panama passed July 5, 1904, and effective October 12, 1904, above fifteen per centum ad valorem, provided for in said act; or if the said Republic should increase at any time the rates of duty on the imported articles described in the other schedules of said act, except on all forms of imported wines, liquors, alcohols, and opium, upon which the Republic may fix higher rates.

"Second. If Article Thirty-eight of the Constitution of the Republic of Panama, as modified by Article One hundred and forty-six thereof, is repealed or modified at any time in so far as the importation and sale of all kinds of merchandise are concerned.

"Third. If the consular fees and charges of the Republic of Panama, in respect to the entry of all vessels and importations into the said ports of Colon and Panama, are increased beyond the rates now in force, which rates are understood to be sixty per centum of the rates in force prior to the promulgation of said order of December 3, 1904; or,

"Fourth. If goods imported into the ports of Colon and Panama, consigned to or designated for any port in the Canal Zone, are at any time subjected in the Republic of Panama to any other direct or indirect impost or tax whatever."

2. Paragraph 3 of the order issued by the Secretary of War, by direction of the President, on January 7, 1905, which contemplates the exclusion from the benefits of the commissaries established and maintained by the Canal Commission of all employees and workmen who are natives of tropical countries is hereby revoked.

J. M. DICKINSON,  
*Secretary of War.*

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No. 7.

EXECUTIVE ORDER.

*To Create a Land Office for the Canal Zone, and for Other Purposes.*

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

SECTION 1. A Land Office for the Canal Zone is hereby created under the jurisdiction of the Department of Law, and subject to the superior direction of the Chairman and Chief Engineer. The Land Office shall be in charge of an Official to be known as Land Agent.

SEC. 2. The papers, maps, records, and other documents relating to the lands owned or controlled by the United States in the Canal Zone, and the lands auxiliary to the Canal in the Republic of Panama outside of the Canal Zone, when not otherwise provided by law, shall be kept in the Land Office in the care and custody of the Land Agent, under such rules and regulations as the Isthmian Canal Commission may establish from time to time.

SEC. 3. It shall be the duty of the Land Agent to render assistance to the Head of the Department of Law in all matters relating to the investigation of land claims and land titles; and under the direction of that officer he shall have the supervision of Government lands to prevent unauthorized intrusions thereon; and shall perform such other duties as may be assigned to him in accordance with law. He shall have such assistants and other help as may be authorized by the Chairman and Chief Engineer.

SEC. 4. The Isthmian Canal Commission may adopt rules and regulations for the government of the Land Office, in conformity with this Order and not inconsistent with the Executive Order of October 7, 1910, entitled: "Executive Order. To prescribe the manner of leasing public lands in the Canal Zone."

SEC. 5. The Isthmian Canal Commission is hereby authorized to enter into an arrangement with the Panama Railroad Company to consolidate the said company's Land Office with the Land Office hereby created, and by which the papers, maps, records, and other documents affecting the Panama Railroad Company's lands in the Canal Zone and the Republic of Panama may be transferred to the Land Office created by this Order, there to be kept in the custody of the Land Agent for the use and benefit of the railroad company; and the arrangement so made may provide that the work now done by the personnel in the Panama Railroad Company's Land Office, including land surveys and investigation of land claims, may be done by the Government Land Agent and other personnel of the Canal Commission.

The arrangement hereby authorized shall be effected upon such terms, in respect to reimbursement and other compensation from the Panama Railroad Company to the Commission, as may be agreed upon by the Isthmian Canal Commission, and the Panama Railroad Company.

SEC. 6. This Order shall take effect thirty days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, January 19, 1911.

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No. 8.

EXECUTIVE ORDER.

*To provide a method of Executing and Recording Deeds, and to Repeal the Executive Order dated March 12, 1907, effective April 15, 1907, relating to the same subject.*

Article 1. No conveyance of immovable property or of an interest therein, or a mortgage thereon, shall be effective except by an instrument in writing, executed and delivered between parties competent to contract, and sufficiently describing the

property conveyed, or mortgaged, and signed by the person executing the same, or if he is not able to write he shall affix his mark thereto,—and duly acknowledged in accordance with the provisions of this order, before some officer authorized to take acknowledgments, provided, however, that a copy of any instrument in writing, affecting immovable property in the Canal Zone, duly executed before a Notary Public in the Republic of Colombia prior to November 3, 1903, or in the Republic of Panama after said date, and authenticated by the Notary Public charged with the custody of the protocol containing the original deed from which the copy was taken, shall be valid and effective as a conveyance of the lands or interests in the lands therein described.

Article 2. The acknowledgments provided for in this order shall be made in the manner and form provided for the husband's acknowledgment in the Executive Order of August 20, 1910, entitled "Executive Order.—Conveyance of Real Estate by Married Women."

Article 3. If for any reason the grantor in the instrument can not appear before the officer authorized to take acknowledgments, the execution of such instrument must be attested by not less than two subscribing witnesses, and may be proven by the oath of one of the subscribing witnesses to such instrument, taken before any of the officers authorized to take acknowledgments, to the effect that he subscribed such instrument as a witness at the request of the grantor, who signed the same in his presence, or who acknowledged to him that he had signed the same, for the purposes and consideration therein expressed.

The Certificate of Acknowledgment shall be sufficient if it is substantially in the following form:

The ..... Judicial Circuit, Canal Zone.

Before me ....., in and for ....., in the Canal Zone, on this day personally appeared ..... known to me (or proven to me on the oath of ....., a credible witness,) to be the person whose name is subscribed as a witness to the foregoing instrument, and after being duly sworn by me, on his oath deposes that he subscribed the same as such witness at the request of ....., the grantor named in the foregoing instrument, and that he saw the grantor execute the same (or that the grantor acknowledged to him that he had executed the same, as the case may be,) for the purposes and consideration therein expressed.

Given under my hand and seal of office this ..... day of ..... A. D. ....

.....  
.....

Article 4. The officers authorized to take acknowledgments under this order shall issue proper certificates of all acknowledgments taken or proven before them.

Article 5. The Clerk of the Circuit Court of the First Judicial Circuit of the Canal Zone shall be, *ex officio*, Registrar of Property of the Canal Zone, and it shall be his duty to record all instruments authorized to be recorded by this order, or any other law or order of the Canal Zone, and presented to him for record, in a well-bound book or books kept by him for that purpose, and he shall attach a certificate to each deed so recorded by him; which certificate shall state the date and hour of the filing of the instrument for record, as well as the book and page or pages of the record upon which the same is recorded;—and shall be signed by him under his official title, and shall be impressed with his seal. The seal of the Registrar shall contain the words "Registrar of Property of the Canal Zone."

He shall keep an index, direct and cross, of the instruments recorded by him, which shall show the names of the grantor and grantee of each instrument recorded by him, the date of the instrument and the date of the filing of the same, and the book and page or pages in which it is recorded.

Article 6. It shall be the duty of the Registrar of Property to keep a file docket wherein he shall note the filing of all instruments when presented to him for record, which docket shall contain the names of the parties to the instrument, the date of the same, and the date and hour of its filing in the Registrar's office; and all such instruments shall be deemed to have been recorded from the time of such filing.

Article 7. No instrument in writing shall be admitted to record in the Registrar's office except such as are acknowledged or authenticated in the manner provided for in this order.

Article 8. The instruments described in Article 1 of this order, and executed in conformity therewith, as well as the instruments described in the Executive Order of August 20, 1910, entitled "Executive Order.—Conveyance of Real Estate by Married Women," and executed in accordance therewith, shall be admitted to record in the Registrar's office.

Article 9. A copy of any Notarial deed relating to property in the Canal Zone, taken from the records in the office of the Registrar of Property of Panama or Colon, Republic of Panama, and recorded therein prior to February 26, 1904, and duly certified by the Registrar issuing the same, shall be recorded in the office of the Registrar of Property of the Canal Zone, in like manner as provided for deeds executed in the Canal Zone.

Article 10. In all cases in which Spanish documents are admitted to registration under the provisions of this order, such documents shall be accompanied by English translations which shall be recorded with them.

Article 11. A copy of any final judgment or decree of a court of competent jurisdiction of the Canal Zone, vesting the title to immovable property or any interest therein, in one or more of the parties to said judgment or decree, and duly certified by the clerk of the court in which the judgment or decree was rendered, as being a true copy of such judgment or decree as the same appears in the Records of the court, shall be admitted to record in the Registrar's office in like manner as provided herein for deeds executed in the Canal Zone.

Article 12. A copy of a judgment or decree of a court of competent jurisdiction of the Republic of Panama, affecting immovable property situated in the Canal Zone, rendered prior to the 26th day of February, 1904, and duly certified by the clerk or secretary of the court rendering such judgment or decree, and by the judge thereof, when the signature of the said judge is authenticated by the Secretary of Foreign Relations of Panama, shall in like manner be admitted to record in the Registrar's office under the provisions of this order.

Article 13. No deed or other instrument in writing affecting immovable property shall be valid against subsequent creditors of, or *bona fide* purchasers for value, without notice, from the owner of such property, unless the same shall have been recorded with the Registrar of Property of the Canal Zone.

Article 14. The Registrars' Offices at Empire and Cristobal shall be discontinued on and after the date on which this order goes into effect, and the books and records of immovable property in those offices shall be transferred to the Registrar's office hereby created, and shall become a part of the records of his office: and after this order takes effect all deeds, or other instruments, required to be recorded by the provisions of this order or any other law or order of the Canal Zone, shall be recorded in the office of the Registrar herein provided for.

Article 15. The Registrar of Property shall be entitled to charge for his services rendered as Registrar, the following fees, United States currency:

For each instrument recorded, including his certificate thereto, ten cents per folio of one hundred words: but no charge shall be less than fifty cents for any one instrument.

For each certified copy issued by him of an instrument recorded in his office, including certificate thereto, ten cents per folio of one hundred words: but no charge shall be less than fifty cents for each copy thereof.

For searching his records and giving a certificate thereto of any fact or facts contained in his records, fifty cents for each certificate: provided that where more than one record book is searched he may charge twenty-five cents for each additional book.

The fees so collected by the Registrar of Property shall be turned in by him to the Canal Zone Treasury.

Article 16. Any instrument in writing mentioned in Article 1 of this order and duly acknowledged or authenticated in the manner therein described, and any deed or other instrument executed and acknowledged in accordance with the provisions of the said order of August 20, 1910, relating to conveyances by married women, may be used in evidence on the trial of any action or special proceedings without the necessity of proof of its execution unless such instrument is attacked for forgery by the affidavit of the adverse parties: provided, however, that such instrument shall not be admissible in evidence without proof of its execution unless the same or a copy thereof be filed with the clerk of the court wherein such action or special proceeding is pending, and due notice is given to the opposite party or his attorney at least three days before the trial of such action or special proceeding.

Article 17. A copy of any instrument duly recorded under the provisions of this order and certified to by the Registrar in charge of the record, may be used in evidence in any judicial proceedings in like manner and effect as might be done with the original if produced, provided such certified copy is filed with the clerk of the court wherein the action or proceeding is pending, and due notice of the filing of such copy is given to the adverse party or his attorney at least three days before the trial or proceedings in which the said copy is to be produced in evidence.



Article 18. All orders or decrees and parts thereof in conflict with this order are hereby repealed, and the Executive Order of March 12, 1907, effective April 15, 1907, relating to the execution and recording of deeds is also hereby repealed: provided, however, that this order shall not affect a deed or other instrument relating to immovable property executed pursuant to the said order of March 12, 1907, prior to the date on which this order shall take effect, and provided further that this order shall not be construed to modify in any manner the Executive Order of August 20, 1910, relating to the conveyance of real estate by married women.

Article 19. This order shall take effect sixty days from its date.

WM. H. TAFT.

THE WHITE HOUSE, February 2, 1911.

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No. 9.

EXECUTIVE ORDER.

By virtue of the authority invested in me, I hereby establish the following Order for the Canal Zone:

ART. 1. If any person, after having been convicted and having served a sentence of imprisonment in the Canal Zone, and after being deported therefrom, returns to the Canal Zone, he shall be deemed guilty of a felony and punished by imprisonment in the penitentiary for one year, and thereafter removed from the Canal Zone in accordance with the laws and orders relating to deportation.

ART. 2. This order shall take effect from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, May 2, 1911.

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No. 10.

EXECUTIVE ORDER.

*Relating to the Arrest and Discharge of Deserting Seamen.*

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

1. If any seaman who shall have signed a contract to perform a voyage shall absent himself from an American vessel at any port or place in the Canal Zone, without leave of the master, or officer commanding in the absence of the master, such master or the Collector of Revenues or his deputy acting as the Shipping Commissioner, may make complaint against such absent seaman to the judge of any Circuit Court of the Canal Zone, who thereupon shall issue his warrant against the seaman complained of in order that he may be brought before him to answer the complaint; and, after a hearing before said judge, if it shall appear that the seaman had signed a contract to perform a voyage on the vessel and that the voyage agreed for is not finished or altered, or that the contract was not otherwise dissolved, and that such seaman has deserted the vessel, or absented himself therefrom without leave, the judge shall commit him to jail to remain there until the vessel shall be ready to proceed on her voyage, or until the master shall require his discharge, and then to be delivered to the master, the latter paying all the costs of such commitment which may be deducted by him from the wages due to such seaman.

2. If it shall appear on the hearing hereinbefore provided for that the voyage of the vessel is continued contrary to agreement, or that the vessel is badly provisioned, or unseaworthy, or that the officers of the ship have been guilty of cruel treatment toward the seaman, he shall be discharged and the judge shall require the master to pay to such seaman one month's wages over and above the wages due at the time of discharge, and to provide him with adequate employment on board some other vessel, or provide him with a passage on board some other vessel bound to the port from which he was originally shipped, or to the most convenient port of entry in the United States, or to a port agreed to by the seaman, and the seaman shall have a lien on the vessel to compel compliance with the order of the judge, who shall have authority to issue all writs necessary to enforce his jurisdiction; and the judge shall cause to be entered upon the crew list and shipping articles and official log the cause of discharge and the particulars in which the cruel or unusual treatment consisted, and shall cause his name to be subscribed thereto officially, and shall cause the entry made in the official

log to be read to the master. The latter's reply thereto, if any, shall likewise be caused to be entered and subscribed in the same manner.

3. If any consul or vice-consul of any foreign government who is commissioned to the government of the Republic of Panama, and is recognized by the United States in the Canal Zone, such foreign government having a treaty with the United States, or with the Republic of Panama, stipulating for the restoration of seamen deserting, shall make application in writing stating that the person therein named has deserted from a vessel of any such government while in any port of the Canal Zone, and shall furnish proof by the exhibition of the register of the vessel, ship's roll, or other official document, that the person named belonged, at the time of the desertion, to the crew of such vessel, it shall be the duty of any judge of any Circuit Court of the Canal Zone, to issue warrants to cause such person to be arrested for examination. If, on examination, the facts stated are found to be true, the person arrested, not being a citizen of the United States, or of the Republic of Panama, shall be delivered up to the consul or vice-consul, to be sent back to the dominions of any such government, or, on the request and at the expense of the consul or vice-consul, shall be detained until the consul or vice-consul finds an opportunity to send him back to the dominions of any such government. No person so arrested shall be detained more than two months after his arrest; but at the end of that time shall be set at liberty, and shall not be again molested for the same cause. If any such deserter shall be found to have committed any crime or offense, his surrender may be delayed until the tribunal before which the case shall be pending, or may be cognizable, shall have pronounced its sentence, and such sentence shall have been carried into effect.

4. This Order shall take effect from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, May 6, 1911.

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No. 11.

EXECUTIVE ORDER.

*Government of the Insane Asylum for the Canal Zone.*

By virtue of the authority vested in me I hereby establish the following Executive Order for the Canal Zone:

SEC. 1. The Asylum for the Insane at Ancon, as heretofore, shall be under the jurisdiction of the Department of Sanitation. The object of said Asylum shall be the curative treatment of the insane.

SEC. 2. The Superintendent of the Ancon Hospital shall be the administrative chief of the Asylum for the Insane, subject to existing laws and orders, and to such rules and provisions as may be issued by the Department of Sanitation in accordance with existing laws and orders. He shall be in charge of the general inspection of buildings, grounds and equipment, and shall have the supervision over the professional and administrative personnel of the Asylum and over the inmates, and shall satisfy himself that all patients receive the care and medical treatment which is best adapted to their comfort and recovery.

He shall see that a proper register of the patients is kept, showing their names, previous residence, occupation, origin and antecedents, and condition at the time of admission, and their mental and physical condition, as well as their medical treatment during the time of their stay in the Asylum shall be recorded. The death or discharge of patients shall be entered in the register.

SEC. 3. No person declared to be insane shall be kept in a jail, prison, hospital for the sick or other similar institution, but shall be sent, with the proper precautions, to the Asylum for the Insane herein provided for.

SEC. 4. The Superintendent of Ancon Hospital, through the physician in charge of the Insane Asylum, may discharge any patient upon filing in his office a written statement that in his judgment such patient has recovered, or that the discharge will not be detrimental or dangerous to the public welfare or injurious to the patient, provided, that before discharging any patient who has not recovered the Superintendent shall satisfy himself by adequate investigation that the relatives or friends of the patient are able and willing to receive and care for such patient.

No patient shall be discharged without suitable clothing.

The discharges referred to in this section do not apply to commitments on judicial orders in criminal cases, in which cases the discharges can be granted only by the Court which directed the commitment of the prisoner.

SEC. 5. No person shall be admitted as a patient in the Asylum for the Insane except upon the order of a Circuit Judge of the Canal Zone, provided, that if a patient is in a state of violent insanity he may be admitted at once into the quarters hereinafter provided for the observation of persons alleged to be insane, without an order of court, upon the written request of the District Physician to the Superintendent of Ancon Hospital; or the patient may be admitted to the observation quarters by said Superintendent without such request, in the absence of the District Physician.

It shall be the duty of the Superintendent of Ancon Hospital to report the case in writing to the Circuit Judge, within twenty-four hours after the patient has been admitted to the observation quarters, and as soon as the Judge shall have received the report he shall proceed to examine and determine the case in like manner as if the petition had been presented to him prior to the patient's admission into observation quarters.

SEC. 6. To obtain the judicial order provided for in the preceding section it shall be necessary for the nearest relative of the person alleged to be insane to present a petition, duly subscribed and sworn to by the petitioner, to the Judge of any Circuit Court of the Canal Zone, which petition shall state the sex, age and nationality, if known, of the patient, and the facts showing his mental infirmity, and, if possible, the history of the case and the form of insanity with which he is suffering and the attending circumstances making it necessary that he be confined in the Asylum. The petition shall be accompanied by a certificate signed by one or more reputable physicians to the effect that such person is insane.

When the nearest relatives of the person alleged to be insane are absent or refuse to act the petition may be made by the District Judge of the District in which the patient resides or is to be found, at the time the application is made, and in that event it shall state that the nearest relatives of the person alleged to be insane are absent or refuse to act.

SEC. 7. The petition provided for in the preceding section shall take precedence over all other matters pending before the court and shall be heard by the judge thereof without delay, and if the facts stated therein are sufficient to satisfy him of the insanity of the person sought to be confined he shall issue orders at once directing that the person alleged to be insane be taken into custody and placed in quarters hereinafter provided, for the proper observation of the case.

The order of the Judge directing that the person alleged to be insane be placed under observation shall be sufficient authority for the Superintendent of the Asylum to admit the patient into the institution for the purposes of observation, there to remain until the observation is concluded; and the Judge shall direct in said order that if the observation shall show that the patient is not insane he shall be set at liberty at once, and the medical officer in charge of such observation shall forthwith report his action thereon to the judge who issued the order.

The observation of the alleged insane person shall be made in suitable quarters within the asylum grounds, by the chief medical officer thereof, or under his direction, and shall be for a period of not more than thirty days, and the judge who issued the order for the detention of the patient may require the medical officer in charge of the case to make reports thereon to him from time to time.

SEC. 8. The observation provided for in this law may be carried on at the residence of the alleged insane person, when, in the opinion of the Judge, that may be done with safety to the patient and the public: and in such cases the Judge may impose such limitations and conditions as in his judgment the interest of the patient and the safety of the public demand.

SEC. 9. It shall be the duty of the physician in charge of the observation to examine the patient and observe the symptoms of his case: within thirty days after the patient is placed under observation the medical officer in charge of the case shall make his report thereon in writing, and shall state whether the patient is sane or insane. The report shall contain a statement of the facts upon which it is based, and shall be sent to the court having jurisdiction of the case, within twenty-four hours after the same has been subscribed by him.

SEC. 10. It shall be the duty of the Judge having jurisdiction of the case, within twenty-four hours after the receipt of the report provided for in the preceding section to render judgment therein, either committing the patient to the Asylum for the Insane or directing that he be turned over to his relatives, able and willing to take care of him, or to order his discharge, in accordance with the findings of the medical officer in charge of the case.

SEC. 11. The relatives of the person alleged to be insane, or the Public Prosecutor, may appear and contest the report of the medical officer, and in such cases the Judge shall hear the evidence presented by the parties and render judgment thereon, either committing the patient to the asylum or directing his discharge as the law and the facts in the case may justify.

SEC. 12. From the judgment of the court rendered in accordance with the preceding section either of the parties may appeal to the Supreme Court of the Canal Zone, which court shall hear and dispose of the case with all reasonable dispatch, giving it precedence over all other matters pending therein.

When an appeal is taken the trial court shall issue such orders as it may deem necessary and proper for the custody and safekeeping of the patient during the hearing of the appeal.

Any person interested in an inmate of the Asylum, who believes he is improperly detained therein, may make application to the Circuit Judge of the First Judicial Circuit for the discharge of such patient. Upon the receipt of such application the Judge shall issue an order to the Superintendent of Ancon Hospital to make a report on the patient's condition, and upon the receipt of such report the Judge shall consider the same, and, in his discretion, may grant or deny the application. Should the Judge be in doubt as to the proper action to take he may cause the patient to be examined by two competent physicians who shall report to the Judge in writing as to whether the patient should be released or detained in the Asylum. If the physicians recommend the detention of the patient the court may deny the application; should they recommend his release the Judge may grant the petition and discharge the patient at once.

The relatives or friends of the patient or the Public Prosecutor, if dissatisfied with the ruling of the Judge may appeal therefrom to the Supreme Court of the Canal Zone, which Court shall dispose of the appeal as in ordinary cases provided for under this Order; and pending the appeal the trial court may make such orders relating to the custody of the patient as may best subserve the interests of the patient and the public.

If the insane person shall be serving a sentence for the violation of the criminal laws, the Circuit Court of the Circuit wherein the conviction shall have been had shall have jurisdiction of the petition for the discharge of the patient from the Asylum.

SEC. 13. The order of the Judge directing that the patient be admitted to the Asylum for the Insane for care and treatment shall also provide that the marshal, or police officer acting as marshal of the court, shall convey the patient promptly under proper escort to the Asylum.

SEC. 14. If any person confined in a prison or penitentiary under the sentence of a court becomes insane he shall be committed to the Asylum for the insane by the Judge of the Circuit Court of the Circuit wherein the patient received his sentence of conviction. In all such cases the provisions of this order, relating to the period of observation of the patient and the trial of the issue as to his insanity shall be observed, provided however, that the period of observation shall be carried out in the infirmary of the prison or penitentiary, unless the Judge, on the advice of the Department of Sanitation is of the opinion that it should take place elsewhere. Whenever a person is committed to the Insane Asylum under the provisions of this section, the order of commitment issued by the court shall include a statement of the offense of which the person was convicted, the term of his imprisonment and the date upon which said term is to expire. Should such person be discharged from the Insane Asylum before the date of the expiration of his term of imprisonment he shall be returned to the penal institution from which he was taken, in order that he may finish his term; and shall be set at liberty if his discharge from the Asylum takes place subsequent to the date of the expiration of his term of imprisonment.

SEC. 15. All expenses connected with cases of insanity, including the cost of observation, transportation, care, treatment and maintenance of the patients, shall be borne by their respective estates, to be paid in due order of administration of their estates in accordance with the probate laws of the Canal Zone, and if the patients are insolvent then the expense shall be borne by the relatives responsible for the care and maintenance of such patients under the law to be recovered by the Isthmian Canal Commission against such relatives in any court of competent jurisdiction; and if the relatives of the patients are also insolvent then such expenditure shall be paid out of the public moneys appropriated for such purposes.

SEC. 16. Nothing contained in this Order shall be construed to repeal or modify the provisions of the Code of Criminal Procedure of the Canal Zone relating to the inquiry into the insanity of the defendants before trial or after conviction.

SEC. 17. Insane patients from the Republic of Panama may be admitted into the Asylum for the Insane, herein provided for, in accordance with the existing agreements between the Canal Zone authorities and the Panamanian authorities, or under such changes and modifications of said agreements as may be made from time to time.

SEC. 18. The Canal Commission is hereby authorized to establish rules and regulations from time to time as may be deemed necessary for the government of the

Asylum for the Insane herein provided for, subject to the approval of the Secretary of War.

Sec. 19. This order shall take effect thirty days from this date.

WM. H. TAFT.

THE WHITE HOUSE, May 10, 1911.

No. 12.

EXECUTIVE ORDER.

By virtue of the authority in me vested, I hereby establish the following Order for the Canal Zone:

SEC. I. Any person who shall board any passenger, freight, or other railway train in the Canal Zone, whether moving or standing, for any purpose and without in good faith intending to become a passenger thereon, and with no lawful business thereon, and with intent to obtain a free ride on such train, however short the distance, without the consent of the person or persons in charge thereof, shall be guilty of a misdemeanor, and shall be punished by fine of not less than five dollars nor more than twenty dollars.

SEC. II. This Order shall take effect thirty days from this date.

WM. H. TAFT.

THE WHITE HOUSE, May 11, 1911.

No. 13.

EXECUTIVE ORDER.

*To Provide for the Collection of a Distillation Tax.*

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

Section 1. On and after the date on which this Order shall take effect, there shall be collected the sum of TEN CENTS on each and every litre or fraction thereof of distilled spirits produced in the Canal Zone from grain, starch, sugar, molasses or any other substance by distillation, or any other alcoholic liquors produced by distillation, for sale or consumption.

Section 2. Manufacturers or distillers of any of the spirits or alcoholic liquors mentioned in the preceding section shall make application in writing to the Collector of Revenues of the Canal Zone, upon a form prescribed by him, for license to engage in business as such manufacturers or distillers. No application shall be granted by the Collector of Revenues unless the applicant secures the payment of the taxes that may accrue under the provisions of this law by executing a bond with two or more good and sufficient sureties to the satisfaction of the Collector of Revenues, conditioned upon the applicant's faithful compliance with this Order and the regulations issued thereunder, and that he will pay all taxes that may be assessed against him under this Order; or in lieu of said bond the Collector of Revenues, in his discretion, may require a money deposit from such applicant to secure the payment of such taxes. The said bond or deposit, as the case may be, to be subject to such rules and regulations in conformity herewith as the Isthmian Canal Commission may from time to time establish.

Section 3. The tax herein provided for shall be computed upon a meter measurement of the output of each still made through a meter of standard make, which shall be attached to the still under the supervision of the Collector of Revenues, or his Deputy, and in a manner satisfactory to said officer, and at the expense of the owner or operator of said still; and the Collector of Revenues shall withhold the license for the operation of said still until the said meter has been attached thereto in the manner herein provided for.

Section 4. The licensed manufacturer or distiller under this law shall be permitted to sell or otherwise dispose of the output of his still, at his place of manufacture or production, in quantities of not less than FIVE GALLONS without the payment of any further license tax than that prescribed by this Order.

Section 5. Any person manufacturing or distilling any of the spirits or alcoholic liquors herein enumerated before obtaining a license to do so from the Collector of Revenues, or before installing the meter herein prescribed, or who shall tamper with any still or meter or connection thereof with intent to defraud the Revenues of the Canal Zone, shall be guilty of a misdemeanor, and upon conviction shall be punished by a fine not exceeding One Thousand Dollars (\$1,000.00) or by imprisonment in the

District Jail for a term not exceeding twelve (12) months, or by both such fine and imprisonment, within the discretion of the court.

Section 6. The Isthmian Canal Commission may from time to time establish such rules and regulations as may seem necessary to execute the provisions of this Order.

Section 7. All laws, orders or decrees in conflict with the provisions of this Order are hereby repealed.

Section 8. This Order will be effective NINETY DAYS from this date.<sup>1</sup>

WM. H. TAFT.

THE WHITE HOUSE, May 13, 1911.

No. 14.

#### EXECUTIVE ORDER.

By virtue of the authority vested in me, the order of May 13, 1911, providing for the collection of a distillation tax in the Canal Zone, is hereby amended so as to be effective August 13, 1911.

WM. H. TAFT.

THE WHITE HOUSE, June 12, 1911.

No. 15.

#### EXECUTIVE ORDER.

*Providing for the Execution of Revocable Licenses for Lots in Townsites in the Canal Zone.*

By virtue of the authority vested in me, the Chairman and Chief Engineer of the Isthmian Canal Commission is hereby authorized to execute revocable licenses for lots in townsites in the Canal Zone, either directly or through such agency as he may direct, such licenses to be revocable at the pleasure of the Chairman and Chief Engineer or such other executive officer as may be in charge in the Canal Zone, licensees to vacate and remove improvements at once without indemnity.

WM. H. TAFT.

THE WHITE HOUSE, June 28, 1911.

No. 1.

#### ORDINANCE.

*Providing for the Licensing and Regulation of Motor Vehicles in the Canal Zone.*

Be it enacted, by the Isthmian Canal Commission, as follows:

SECTION 1. That, hereafter, there shall be collected and accounted for, as other similar taxes, the following license taxes from the owners or operators of motor vehicles used or employed on the streets or roads of the Canal Zone, namely; (a) for each motor vehicle (except motor cycles) used for the transportation of freight or passengers for hire, or for the transportation of merchandise or freight by any merchant or dealer, one hundred fifty dollars (\$150.00) per annum; (b) for each motor vehicle (except motor cycles) operated for pleasure, twenty-five dollars (\$25.00) per annum; and (c) for each motor cycle ten dollars (\$10.00) per annum.

Sec. 2. Before any person shall use or operate any motor vehicle on the public roads or streets of the Canal Zone, he shall procure from the Collector of Revenues of the Canal Zone Government a license authorizing him to so use and operate such motor vehicle on said public roads or streets.

Sec. 3. Each motor vehicle operated on said roads or streets shall at all times when so operated carry thereon, at a conspicuous place at the rear thereof, a metal tag or card bearing thereon, in large numerals, the number of the license for such vehicle. It shall be the duty of the Collector of Revenues, when such license is issued, to furnish to the licensee said metal tag or card bearing said number, and the licensee shall, in addition to the license tax, pay to said Collector a fee of one dollar (\$1.00)

<sup>1</sup> Amended by Executive Order of the President dated June 12, 1911.

for furnishing said tag or card, which fee shall be accounted for by said Collector to the Zone Government in the same manner as are such license taxes. It shall be unlawful for any person to operate or use on said roads or streets any motor vehicle unless the same bears, at a conspicuous place at the rear thereof, such numeral tag or card.

SEC. 4. The Collector of Revenues shall keep a register, wherein he shall number, in consecutive order, all licenses granted by him under this ordinance, and the names of the licensees, and a brief description of the motor vehicle licensed. Such register shall be a public record. Said Collector shall, immediately upon issuing any license herein provided for, give notice thereof, and furnish any license herein provided for, give notice thereof, and furnish the information shown by the aforesaid register, to the Chief of Police, who shall cause arrests to be made for violations of this ordinance.

SEC. 5. Before the Collector of Revenues shall issue any license hereunder for the operation of any motor vehicle, he must be satisfied, from proof furnished, or from his personal investigation, that such motor vehicle for which the license is desired can pass with ease and safety on any turn or part of any public road or street of the Canal Zone any other vehicle authorized by law to travel thereon. The said Collector's refusal to issue any license indicated herein may, upon the formal request of the refused applicant, be reviewed by the head of the Department of Civil Administration, whose decision shall be final.

SEC. 6. All motor vehicles shall, when being operated on any of the Canal Zone streets or roads, between the hours of 6.00 p. m. and 5.00 a. m., carry and prominently display lights as follows: Automobiles, or motor vehicles of similar construction, two bright front or headlights, one on either side and one red light at the rear; motor cycles, one bright headlight.

SEC. 7. Except as to requirements for the use of lights, as provided in Section 6 hereof, this ordinance will not apply to motor vehicles which may be used on the public roads or streets of the Canal Zone under the authority of the Chairman of the Isthmian Canal Commission or of the Secretary of War, for official purposes.

SEC. 8. The term "motor vehicle" as used herein, shall apply to and include every vehicle or conveyance which may be drawn or propelled by means of steam, gas, naphtha, fluid, electricity, or other similar motor power.

SEC. 9. Any person violating any provision of this ordinance shall be deemed guilty of a misdemeanor, and shall, upon conviction in any district court of the Canal Zone, be punishable by a fine not to exceed fifty dollars (\$50.00), or imprisonment not to exceed 30 days, or by both such fine and imprisonment in the discretion of the court.

SEC. 10. This ordinance shall be effective from the date of its approval by the Secretary of War.

Enacted by the Isthmian Canal Commission at the 158th meeting, August 25, 1910.

Approved by the Acting Secretary of War, October 31, 1910.

## No. 2.

### ORDINANCE.

*Amending Paragraph "a" Section 7, of the "Regulations Providing for Certain Taxes and Licenses in the Canal Zone other than for the Sale of Intoxicating Liquors," effective July 1, 1908.*

Be it enacted, by the Isthmian Canal Commission, that paragraph "a," Section 7, of the "Regulations Providing for Certain Taxes and Licenses in the Canal Zone other than for the Sale of Intoxicating Liquors," effective July 1, 1908, is hereby amended to read as follows:

"For operating for hire a public coach or carriage, not operated by motor power, for the transportation of passengers, a license tax of \$1.25 per month shall be charged; for a public cart, dray, or other public vehicle not operated by motor power the following license taxes shall be charged; namely, for each two-wheel vehicle, \$2.50 per month; for each four-wheel vehicle, \$5.00 per month. Provided, however, that in the construction and application of this section all vehicles which are used on the public roads of the Canal Zone for the transportation of merchandise, or other articles of value, by merchants and dealers, shall be held to be subject to license as provided in this section. Provided, however, that the license taxes in this section enumerated shall not apply to conveyances of the herein indicated character wherein passengers are transported for hire which are duly licensed in the Republic of Panama."

Enacted by the Isthmian Canal Commission at the 158th meeting, August 25, 1910.

Approved by the Acting Secretary of War, October 31, 1910.

## No. 3.

## ORDINANCE.

*Providing for the Fixing of Rates of Charges to be Made for the Transportation of Passengers over the Streets and Roads of the Canal Zone.*

Be it enacted by the Isthmian Canal Commission, as follows:

SECTION 1. The Head of the Department of Civil Administration is hereby empowered and directed to fix rates of charges which may be made and collected by persons engaged in the transportation of passengers for hire over the streets and roads of the Canal Zone by means of any automobile, or other motor vehicle of similar construction or operation, or by means of any carriage, surrey, wagon, cart, or other conveyance drawn by horses or mules. He is also empowered and directed, at any time when circumstances may appear to warrant, to revise or change such rates as may have been theretofore fixed by him. Said rates shall be reasonable.

SEC. 2. Immediately upon fixing such rates of charges or upon any revision or change thereof being made by him, the Head of the Department of Civil Administration shall promulgate said rates or charges or any revision thereof in the following manner, to wit:

(a) By publication thereof in two consecutive issues of *The Canal Record*;

(b) By publication thereof, by printed posters posted conspicuously in each of the following places: At the various police stations of the Canal Zone; at the various passenger stations of the Panama Railroad in the Canal Zone and in the Republic of Panama; at the postoffice buildings in the Canal Zone, and at any other points as may seem to him proper in order that due notice thereof to the public may be given.

SEC. 3. The Head of the Department of Civil Administration shall also cause to be printed a sufficient number of cards or pamphlets containing such rates of charges so fixed or revised by him as may be necessary to furnish a copy thereof to each person driving or operating any conveyance of the hereinbefore indicated character for the transportation of passengers for hire in the Canal Zone; and it is hereby made the duty of all such persons to secure from the Head of the Department of Civil Administration such copy, and to keep same at all times conspicuously posted or displayed in each such conveyance so used or operated; and a failure so to do will constitute a violation of this ordinance.

SEC. 4. When rates for such transportation shall have been fixed and promulgated, as by this ordinance directed, any person who shall charge and collect for the transportation of any person over the streets or roads of the Canal Zone in either of the hereinbefore indicated conveyances any sum in excess of such prescribed and promulgated rates, shall be held to have committed a violation of this ordinance; and any person who has received for himself or others such transportation in the Canal Zone, and who fails or refuses to pay therefor the rate thus prescribed and promulgated, shall, likewise, be held to have committed a violation of this ordinance. *Provided, however*, a rate different from that promulgated hereunder may be charged and paid if the parties to the transaction may agree thereon; but if there be any dispute as to such agreement the duly prescribed rate shall prevail.

SEC. 5. Any person, firm, or corporation who fails to comply with any requirement or provision of this ordinance; or who charges and receives any rate in excess of that prescribed by the Head of the Department of Civil Administration, or who refuses to pay any rate prescribed by the Head of the Department of Civil Administration, agreeably to the provisions of this ordinance, shall be held to be guilty of a misdemeanor, and upon conviction shall be fined for each offense a sum not exceeding twenty-five dollars (\$25.00).

Enacted by the Isthmian Canal Commission at the 158th meeting, August 25, 1910.

Approved by the Secretary of War, December 3, 1910.

## No. 4.

## ORDINANCE.

*Amending Section 4 of the Rates, Rules, and Regulations Governing the Use of Water in the Canal Zone.*

*Resolved*, That Section 4 of the Rates, Rules and Regulations Governing the Use of Water in the Canal Zone, adopted at the 136th Meeting of the Isthmian Canal Commission, be, and the same hereby is, amended to read as follows:

"SECTION 4. Charge shall be made for all connections with the water mains and sewers in accordance with the schedule contained in Section 11 of these regulations.



Should the owner or lessee of a building having water connections refuse or neglect to pay his water bill for a period of forty-five (45) days after the expiration of the quarter for which bill is rendered, this fact shall be reported to the Head of the Department of Civil Administration, who shall collect the bill by due process of law. All charges for water, including those for turning off and on water, as hereinafter provided, and all costs for collection shall be assessed against the building or property where the water was used, and become a lien thereon. When a bill for water becomes delinquent the water shall be turned off from the connection against which the bill is rendered, and no water shall be delivered through the connection until the bill is paid; *Provided*, That a fee of one dollar (\$1) for turning off water on account of failure to pay water rents shall be added to each such unpaid bill, and after payment of such delinquent bill a fee of one dollar (\$1) shall be charged for again turning on the water for a connection from which it was turned off on account of non-payment of water rent bill. Fees collected for turning on and off water shall be credited and remitted as water rents."

Enacted by the Isthmian Canal Commission at its 159th meeting, held January 28, 1911.

Approved by the Secretary of War, February 11, 1911.

### No. 5.

#### ORDINANCE.

#### *Providing for the Licensing and Regulation of Bicycles in the Canal Zone.*

Be it enacted by the Isthmian Canal Commission:

Section 1. Before any bicycle shall be ridden or operated over any of the streets or roads of the Canal Zone the owner or custodian of such bicycle shall secure from the Collector of Revenues a license authorizing the use of such bicycle over said streets and roads; and the owner or custodian shall also secure from the Collector of Revenues a metal tag bearing thereon, in plainly visible numerals not less than two inches in height, the serial number of the license issued to cover the use of such bicycle.

Section 2. The Collector of Revenues shall register the name of the owner or custodian of each bicycle licensed by him, together with the number of the license and metal tag furnished the owner or custodian and a brief description showing the name of the manufacturer, and factory number of the bicycle.

Section 3. No bicycle shall be ridden or operated over the streets or roads of the Canal Zone unless it shall bear thereon the aforesaid numeral metal tag prominently displayed beneath the saddle thereof; nor shall it be so ridden or operated between the hours of 6.30 p. m. and 6 a. m. unless it shall also carry and prominently display a headlight. No bicycle shall be operated unless it carries a bell or horn whereby signals of warning shall be given by the rider to persons and vehicles met or overtaken on the aforesaid streets or roads.

Section 4. It is hereby made the duty of all persons who may rent bicycles to others for use to keep a full record showing the name of each person to whom such rental is made, the license number of the bicycle, and the hour when each bicycle goes out for use and the hour it returns; and it shall be the duty of each person renting bicycles to others to carefully preserve such record and to at all times permit the members of the Zone police or of the office of the Collector of Revenues to examine such records.

Section 5. The bicycle license herein provided for shall be issued to cover the unexpired portion of the fiscal year in which it is issued, and the party receiving same shall pay to the Collector of Revenues the sum of one dollar (\$1) for the license and numeral metal tag, which shall entitle the bicycle so licensed to be ridden over any of the streets or roads of the Canal Zone during the license period.

Section 6. No bicycle shall be ridden over the streets or roads of the Canal Zone at a greater speed than seven (7) miles an hour in cities, towns, or villages, nor at a greater rate of speed outside of cities, towns, or villages than fifteen (15) miles an hour on straight roads, or eight (8) miles an hour when approaching curves, forks, or crossroads.

Section 7. The Collector of Revenues shall promptly furnish to the Chief of Police statements showing to whom he has issued the bicycle licenses herein provided for, and the Chief of Police shall in turn transmit to the Canal Zone police stations the information shown by such statements.

Section 8. Any person who rides a bicycle over any road or street of the Canal Zone, without there being displayed thereon the license numeral tag herein required, or who fails to comply with the requirements of this Ordinance as to lights and signals,

or any owner or custodian who shall rent or loan to another any bicycle for the use of which the license herein required has not been secured, or any other person who shall fail to comply with any requirement herein imposed on him, shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not exceeding twenty-five dollars (\$25) for each offense.

Enacted by the Isthmian Canal Commission at its 160th meeting, April 15, 1911.

Approved by the Secretary of War, April 26, 1911.

No. 6.

ORDINANCE.

*Providing for the Licensing of Chauffeurs for Automobiles.*

Be it enacted by the Isthmian Canal Commission, as follows:

Section 1. That hereafter it shall be unlawful for any person to operate over the streets and roads of the Canal Zone any automobile without first having obtained a license as chauffeur, as in this ordinance provided.

Section 2. Each person desiring to operate any automobile over the streets and roads of the Canal Zone shall first make written application to the Board of Local Inspectors of the Canal Zone, stating his nationality, age, and character of experience in the operation of automobiles and gasoline and electric machinery; and shall also have his application indorsed by two reputable citizens of the Canal Zone or of the cities of Colon or Panama, Republic of Panama, vouching for his sobriety and trustworthiness. The Board of Local Inspectors shall thereupon examine the applicant touching his knowledge of gasoline and electrical motors and machinery, and of the mechanism and operation of automobiles, as well as upon his knowledge of the English or Spanish language, and upon laws and regulations of the Canal Zone relating to the operation of automobiles over the streets and roads of the Canal Zone. In order to determine the skill of any applicant, said Board may require him to make a practical demonstration thereof.

Section 3. No person shall be granted a chauffeur's license unless he is not less than eighteen years of age, is of sober habits, is able to read either the English or Spanish language, and shall prove to the satisfaction of the Board of Local Inspectors that he has the knowledge, skill and judgment necessary for the safe and skillful driving and handling of automobiles.

Section 4. The Board of Local Inspectors shall meet at Ancon, Cristobal, or at such other points in the Canal Zone as it may designate, at such times as may be convenient to it, and shall examine applicants for licenses hereunder; and the Board shall keep a careful record of all such applications, and of its action thereon, together with any papers submitted in connection with such applications and examinations.

Section 5. Upon the completion of an examination, as herein provided for, the Board of Local Inspectors shall make a report to the Head of the Department of Civil Administration showing whether the applicant is competent under the provisions of this ordinance to operate automobiles over Canal Zone streets and roads, and if the Board's recommendation is to the effect that the applicant is thus competent, the Head of the Department of Civil Administration shall thereupon issue to the applicant a license in form substantially as follows:

THE GOVERNMENT OF THE CANAL ZONE.

LICENSE TO CHAUFFEURS.

No. ....

Whereas, it has been reported to me by the Board of Local Inspectors that ..... has given satisfactory evidence to said Board that he is a skillful chauffeur or operator of automobiles, and can be intrusted to perform the duties of chauffeur upon the streets and roads of the Canal Zone, he is therefore licensed to act as such chauffeur until such time as this license may, for cause, be revoked.

Witness my hand and seal this .... day of ..... 19....

.....  
*Head of Department of Civil Administration.*

Countersigned:

.....  
*Chairman, Board of Local Inspectors.*

Section 6. Coincident with the issuance of any chauffeur's license, the Collector of Revenues, upon the direction of the Head of the Department of Civil Administration,

shall deliver to the licensee a metal check or badge having stamped thereon the serial number of the licensee's license and the words and letters "Chauffeur's License, C. Z." It shall be the duty of each person holding such chauffeur's license to wear or carry with him said check or badge when he is driving any automobile over Canal Zone streets or roads. For such badge and license, each such licensee shall pay to the Collector of Revenues one dollar (\$1), same to become a part of the revenues of the Canal Zone Government. Upon the request of any Canal Zone police officer any such licensee, while in charge of any automobile on Canal Zone streets or roads, shall exhibit such badge.

Section 7. The said chauffeur's license shall continue in force until it may be revoked for cause, as herein provided for.

Section 8. The Head of the Department of Civil Administration is hereby given the right to revoke any license hereunder issued when it shall appear to him that the holder thereof, because of drunkenness or lack of skill in operating automobiles, should not be further intrusted with the operation of automobiles over Canal Zone streets and roads.

Section 9. The term "automobile," as herein used, shall apply to all vehicles of automobile, or similar, construction and operation.

Section 10. Any person who operates an automobile over the streets and roads of the Canal Zone without first having obtained a license as herein provided for, and without complying with any other requirements of this ordinance applicable to him, shall be guilty of a misdemeanor, and upon conviction thereof shall be subject to a fine of not less than \$25; and upon any subsequent conviction may, in addition to having such fine adjudged against him, be confined in the district jail for a period not to exceed thirty (30) days.

Enacted by the Isthmian Canal Commission at its one hundred and sixtieth meeting, April 15, 1911.

Approved by the Secretary of War, April 26, 1911.

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#### No. 7.

#### ORDINANCE.

#### *Prohibiting Hunting and Other Trespassing upon Reservoirs and Watersheds of the Canal Zone.*

Be it ordained by the Isthmian Canal Commission:

Section 1. It shall be unlawful for any person to hunt on any of the reservoirs of the Canal Zone, from which water is drawn for the use of the inhabitants of any city, municipality, district or settlement or on any of the established watersheds of any such reservoirs; and no person, except under authority of the Isthmian Canal Commission or the Panama Railroad Company, shall enter upon any of said reservoirs or watersheds for any purpose.

Section 2. Any person who violates any of the provisions of this ordinance shall be deemed guilty of a misdemeanor, and shall be punished as prescribed by Section 16 of the Penal Code.

Section 3. This ordinance shall take effect thirty days after its approval by the Secretary of War.

Enacted by the Isthmian Canal Commission at its 160th meeting, April 15, 1911.

Approved by the Secretary of War, April 26, 1911.

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#### No. 8.

#### ORDINANCE.

#### *Establishing Rules, Regulations, and Instructions for the Government of the Division of Fire Protection of the Canal Zone.*

Be it ordained by the Isthmian Canal Commission, That the Rules and Regulations and Instructions for the Division of Fire Protection of the Canal Zone, approved by the Chairman and Chief Engineer on February 14, 1911, and effective April 1st, 1911, are hereby established for the Canal Zone.

This Ordinance shall take effect from and after the date of its approval by the Secretary of War.

GEO. W. GOETHALS,  
Chairman.

Enacted by the Isthmian Canal Commission, April 29, 1911.

Approved by the Secretary of War, May 19, 1911.

#### APPENDIX VIII.—STEAMBOAT-INSPECTION SERVICE.

TABLE 50.—*Licenses issued by the board of local inspectors during the fiscal year ended June 30, 1911.*

<b>Masters' licenses:</b>	
Master of steam launches.....	3
Master of towboats.....	1
Master of ladder dredges.....	2
Master of suction dredges.....	11
	<hr/> 17
<b>Engineers' licenses:</b>	
Chief and second engineers of self-propelling barges.....	5
Chief and second engineers of towboats.....	1
Chief, second, and third engineers of all classes dredges.....	5
	<hr/> 11
<b>Mates' licenses:</b>	
Mate of towboats.....	1
Mate of dredges, all classes.....	11
	<hr/> 12
<b>Pilots' licenses:</b>	
Pilot of self-propelling hopper barges.....	1
Pilot of towboats.....	3
Pilot of passenger and cargo steamers, any tonage.....	52
	<hr/> 56
	<hr/> 96

<sup>1</sup> Of the 17 licenses issued to masters, 4 were issued as joint master-pilot licenses.

## APPENDIX IX.—DIVISION OF FIRE PROTECTION.

TABLE 51.—Detailed statement of fires during the fiscal year ended June 30, 1911.

Town.	Date.	Description.	Owner.	Total value.	Total loss.	Cause of fire.	How extinguished.
Cristobal	1910.						
Colon	July 4	Rubblish	Isthmian Canal Commission			Unknown	Fire extinguisher.
do	July 4	2-story frame hotel	Panama R. R.	\$40,000.00	\$41.99	Electric light	Do.
Gorgona	July 6	Frame shed	Isthmian Canal Commission	5,441.00		Crossed electric wires	Line of hose.
Culebra	July 7	Frame dwelling	do			Chimney burning out	Allowed to burn out.
Miraflores	July 11	Frame storehouse	do	3,550.00	1.02	Unknown	Fire extinguisher and line of hose.
Empire	July 13	Frame dwelling	Private	4,200.00	25.00	Spontaneous combustion	Pails of water.
Tabernilla	July 15	do	Isthmian Canal Commission	1,150.00	1.50	Overheated stove	Fire extinguisher.
Culebra	July 16	do	do			Burning grease	Smothered out.
Colon	July 16	Frame hotel	Panama R. R.			Struck by lightning	No fire.
Do	July 16	Tar boiler	do			Fire under boiler	Smothered out.
Gatun	July 29	Frame telephone exchange	Isthmian Canal Commission	4,000.00	100.00	Unknown	Lines of hose and extinguishers.
Gorgona	Aug. 1	Scrap lumber	Private	1,800.00	110.00	Spontaneous combustion	Line of hose.
Gatun	Aug. 7	Trestle	Isthmian Canal Commission	1,147.70	147.70	Sparks from chimney	Do.
Gorgona	Aug. 11	Frame dwelling	Private	13,200.00	5.00	Candle ignited clothing	Pails of water.
Gorgona	Aug. 15	Frame machine shops	Isthmian Canal Commission	17,000.00	15.00	Hot coals from forge	Line of hose.
Empire	Aug. 17	Frame dwelling	do	10,850.00		Explosion of alcohol	Fire extinguishers.
Gorgona	Aug. 18	Frame machine shops	do			Overheated locomotive	Do.
Cristobal	Aug. 26	Frame bakery	Panama R. R.	2,377.25		Sparks from locomotive	Do.
Do	do	Frame hotel	Isthmian Canal Commission			Burning grease	Fire extinguisher.
Tabernilla	Aug. 29	Frame dwelling	do			Kerosene on stove	Burned itself out.
Cristobal	Sept. 4	Barge	do	25,000.00	10.00	Oil from feed pipe	Pails of water and line of hose.
Do	Sept. 7	Power plant, concrete	do			Heat from boilers	Burning plank thrown out.
Mount Hope	Sept. 15	Scrap rope and timber at dry dock	do	30,000.00		Sparks from locomotive	Line of hose.
Corozal	Sept. 16	Frame dwelling	do	1,150.00	7.95	Child playing with matches	Fire extinguishers.
Balboa	Sept. 17	Power plant	do	260,000.00	1.00	Heat from boilers	Do.
Gorgona	Sept. 23	Frame restaurant	Private	1,200.00	10.00	Unknown	Pails of water.
Gatun	Sept. 28	False alarm	do				Do.
Las Cascazas	Oct. 5	Frame dwelling	Isthmian Canal Commission	400.00	8.00	Explosion of oil stove	Smothered out.
Gatun	Oct. 6	do	Private	1,600.00	15.00	Overheated chimney	Fire extinguisher.
Tabernilla	Oct. 10	do	Isthmian Canal Commission	15,916.00	280.00	Heat from range	Extinguishers and line of hose.
Bas Obispo	Oct. 15	Frame hotel	do				
Culebra	Oct. 16	False alarm	do				
Colon	Oct. 17	do	do				
Do	Oct. 18	do	do				
Culebra	Oct. 18	Frame dwelling	Private	825.00	10.00	Overheated stove	Fire extinguishers.
Mount Hope	Nov. 13	Garbage can in storehouse	Isthmian Canal Commission			Spontaneous combustion	Pails of water.
Colon	Nov. 23	False alarm	do				

Culebra.....	Dec. 2	Frame dwelling.....	Isthmian Canal Commission.....	1,700.00	Explosion of alcohol.....	Smothered out. Line of hose.
Cristobal.....	Dec. 6	Load of hay.....	do.....	7.95	Unknown.....	Line of hose.
Balboa.....	Dec. 9	Freight car.....	Panama R. R.....	3,000.00	Spontaneous combustion.....	Fire extinguishers. Line of hose.
Do.....	Dec. 10	do.....	do.....	3,000.00	do.....	do.....
Do.....	Dec. 10	do.....	do.....	1,700.00	do.....	do.....
San Pablo.....	Dec. 13	Frame commissary.....	do.....	6,000.00	Explosion of lamp.....	Fire extinguisher.
Toro Point.....	Dec. 17	Gasoline launch.....	Private.....	8,900.00	Explosion of gasoline.....	Sunk in bay.
Paraiso.....	do.....	Frame dwelling.....	Isthmian Canal Commission.....	2,145.00	Explosion of alcohol.....	Fire extinguisher and line of hose.
Balboa.....	Dec. 19	Charcoal.....	Panama R. R.....	1,700.00	Unknown.....	Line of hose.
Do.....	do.....	Freight car.....	do.....	25.00	Spontaneous combustion.....	do.....
Panama.....	Dec. 20	False alarm.....	do.....	2,500.00	Spontaneous combustion.....	do.....
Balboa.....	Dec. 20	Freight car.....	Panama R. R.....	1,200.00	Overheated stove pipe.....	Fire extinguisher.
Nombres de Dios.....	Dec. 21	Houseboat.....	Isthmian Canal Commission.....	20.00	Fire in dump.....	Line of hose.
Cristobal.....	Dec. 25	Freight car.....	do.....	53.28	Spontaneous combustion.....	do.....
Balboa.....	Dec. 26	do.....	Panama R. R.....	1,700.00	Overheated oven.....	Fire extinguishers.
Gorgona.....	Dec. 30	Frame hotel.....	Isthmian Canal Commission.....	20.00	Sparks from locomotive.....	Fire extinguisher.
Cornel.....	Dec. 31	Oil tank.....	do.....	40.00	Overheated stove pipe.....	Fire extinguishers.
Porto Bello.....	do.....	Frame dwelling.....	do.....	7,370.00	do.....	do.....
1911.						
Culebra Gut.....	Jan. 1	Freight cars.....	do.....	39,000.00	Hot coals under car.....	do.....
Pedro Miguel.....	Jan. 3	Scrap lumber.....	do.....	600.00	Unknown.....	Line of hose.
Tabernille.....	Jan. 4	Frame dwelling.....	do.....	9,000.00	Explosion of oil stove.....	Smothered out.
San Pablo.....	do.....	Frame hotel (old French).....	do.....	.....	Unknown.....	Line of hose.
Mount Hope.....	Jan. 5	Grass.....	do.....	.....	Sparks from locomotive.....	Fire extinguisher.
Cristobal (on canal).....	do.....	Tug "Reliance".....	Isthmian Canal Commission.....	75,000.00	Heat from boiler.....	Line of hose.
Porto Bello.....	Jan. 7	Piling.....	do.....	1,500.00	Sparks from locomotive.....	Pails of water.
Gatun.....	Jan. 9	Grass beside oil house.....	do.....	11,265.47	do.....	Fire extinguishers.
Balboa.....	Jan. 10	Freight car.....	Panama R. R.....	1,700.00	Spontaneous combustion.....	Line of hose.
Culebra.....	do.....	False alarm.....	do.....	.....	Sparks from locomotive.....	Pails of water.
San Pablo.....	do.....	Frame hotel (old French).....	Isthmian Canal Commission.....	.....	do.....	Fire extinguishers.
Do.....	do.....	Railroad ties.....	Panama R. R.....	.....	do.....	Pails of water.
Gatun.....	Jan. 11	Frame hotel (old French).....	Isthmian Canal Commission.....	241.50	do.....	Line of hose.
Cristobal.....	do.....	Piling.....	do.....	3,836.50	do.....	do.....
Gatun.....	Jan. 13	Grass.....	Panama R. R.....	.....	do.....	Fire extinguisher.
Cristobal.....	do.....	Crescoted piling.....	Isthmian Canal Commission.....	2,256.00	Burning paper.....	Line of hose.
Do.....	do.....	Crescoted piling.....	Panama R. R.....	.....	Fire in dump.....	do.....
Gatun.....	Jan. 14	Grass.....	do.....	1,621.00	Sparks from locomotive.....	Fire extinguisher.
Cristobal.....	do.....	Crescoted piling.....	Panama R. R.....	.....	do.....	Stamped out.
Gatun.....	Jan. 16	Grass.....	Isthmian Canal Commission.....	6,000.00	do.....	do.....
Do.....	Jan. 17	Frame repair shop.....	do.....	7.00	Sparks from engine.....	Pails of water.
Do.....	Jan. 18	Dock No. 1.....	do.....	12,500.00	Sparks from locomotive.....	Line of hose.
Do.....	Jan. 20	Crescoted piling.....	do.....	416.00	Explosion of alcohol.....	Smothered out.
Culebra.....	Jan. 22	Frame dwelling.....	do.....	.....	Unknown.....	Extinguisher and line of hose.
Gatun.....	Jan. 23	Scrap lumber.....	do.....	.....	do.....	do.....
Colon.....	do.....	False alarm.....	do.....	.....	Unknown.....	Fire extinguishers.
Gatun.....	do.....	Grass.....	Isthmian Canal Commission.....	15.00	Sparks from locomotive.....	do.....
Toro Point.....	do.....	Tool boxes.....	do.....	.....	Unknown.....	Pails of water.
Culebra.....	do.....	Grass.....	Isthmian Canal Commission.....	416.00	Burning paper.....	Line of hose.
Gatun.....	do.....	Piling.....	do.....	.....	do.....	do.....

## APPENDIX IX.—DIVISION OF FIRE PROTECTION.

TABLE 51.—Detailed statement of fires during the fiscal year ended June 30, 1911—Continued.

Town.	Date.	Description.	Owner.	Total value.	Total loss.	Cause of fire.	How extinguished.
San Pablo.	Jan. 25	Frame dwelling.	Isthmian Canal Commission.	\$8,100.00	\$10.00	Child playing with matches.	Fire extinguishers.
Empire.	do.	Frame repair shop.	Private.	15.00	15.00	Spontaneous combustion.	Fire extinguisher.
Mount Hope.	Jan. 26	Timber.	Isthmian Canal Commission.			Hot rivet.	Line of hose.
Paraiso.	Jan. 27	Old frame machine shop.	do.	14,184.73	1.00	Sparks from locomotive.	Do.
Mount Hope.	do.	Grass.	do.			do.	Pails of water.
Do.	do.	do.	do.			do.	Do.
Gatun.	do.	Railroad ties.	Panama R. R.	5,000.00		do.	Smothered out.
Toro Point.	do.	Scrap lumber at repair shop.	Isthmian Canal Commission.	1,100.00		do.	Line of hose.
Cristobal.	do.	Crescoted piling.	do.	3,072.00		do.	Pails of water.
Pedro Miguel.	Jan. 28	Railroad ties.	Panama R. R.	27.60		Fire in dump.	Do.
Gatun.	Jan. 29	Scrap lumber.	Isthmian Canal Commission.			do.	Line of hose.
Mount Hope.	Jan. 31	Grass near lumber.	do.	443.66		Sparks from locomotive.	Fire extinguisher.
Culebra.	do.	Frame dwelling.	do.	14,000.00		Hot coals from locomotive.	Smothered out.
Cristobal.	Feb. 1	Crescoted piling.	Panama R. R.	6,283.41	3.00	Child playing with matches.	Fire extinguishers.
Do.	do.	Frame dwelling.	Isthmian Canal Commission.	714.50		Sparks from locomotive.	Stamped out.
Do.	do.	Frame dwelling.	do.	4,800.00	3.00	Defective flue.	Fire extinguisher.
Las Cascadas.	do.	False alarm.	do.				
Gatun.	Feb. 2	Frame coal chute.	Isthmian Canal Commission.	34,000.00	50.00	Spontaneous combustion.	Line of hose.
Jamaicatown.	Feb. 4	Building material.	do.	150.00		Sparks from locomotive.	Fire extinguisher.
Empire.	do.	Frame dwelling.	do.	700.00		Charcoal stove.	Do.
Cristobal.	Feb. 5	do.	Private.	2,650.00		Kerosene lamp.	Smothered out.
Paraiso.	Feb. 7	Freight car.	Panama R. R.	971.28	8.43	Sparks from locomotive.	Line of hose.
Panama.	do.	Bridge 571.	do.	11,646.88	3,127.60	Unknown.	Lines of hose.
Gatun.	do.	False alarm.	do.				
Do.	Feb. 8	Frame storehouse.	Isthmian Canal Commission.	6,500.00		Sparks from locomotive.	Line of hose.
Do.	do.	Frame dwelling.	do.	8,675.00	2.00	Overheated stovepipe.	Pails of water.
Ancon.	Feb. 9	Cement barrels at storehouse.	do.	171,601.65		Sparks from locomotive.	Line of hose.
Do.	do.	Grass.	do.			Burning grass.	Allowed to burn out.
Bohio.	do.	False alarm.	do.				
Gorgona.	Feb. 11	Frame dwelling.	Isthmian Canal Commission.	2,000.00	2.00	Burning out hornets' nest.	Pails of water.
Gatun.	Feb. 15	Frame hotel.	do.	30,750.00		Grease on range.	Line of hose.
Do.	Feb. 18	Grass.	do.			Sparks from locomotive.	Do.
Gorgona.	do.	Frame platform.	Isthmian Canal Commission.	41.00		do.	Fire extinguisher.
Gatun.	Feb. 20	Frame machine shops.	do.	50,000.00		Hot rivet under floor.	Line of hose.
Culebra.	Feb. 21	Timbers.	do.	60.00		Sparks from locomotive.	Do.
Gorgona.	Feb. 22	Piling.	do.	450.00		Unknown.	Do.
Pedro Miguel.	Feb. 23	Frame machine shops.	do.	50,000.00		Overheated furnace.	Pails of water.
Do.	do.	Storage trestle.	do.	28,048.00	5.00	Unknown.	Fire extinguishers and pails of water.
Mount Hope.	Feb. 24	Scrap rope.	do.			Sparks from locomotive.	Line of hose.

Gatun.....	Feb. 26	Wooden frames.....	do.....	225.00	225.00	Unknown.....	Do.
Do.....	Feb. 27	Grass.....	Isthmian Canal Commission.			Sparks from locomotive.....	Do.
Do.....	do	Oil near platform.....	Panama R. R.	60.00		Unknown.....	Do.
Mataschin.....	Feb. 28	Railroad ties.....	Isthmian Canal Commission.	700.00		Sparks from locomotive.....	Fire extinguisher.
Panama.....	Mar. 1	Grass near dwelling.....	do.....	700.00		Unknown.....	Line of hose.
Gatun.....	do	False alarm.....	do.....				Do.
Culebra.....	do	Frame dwelling.....	Private.....			Unknown.....	Pails of water.
Do.....	Mar. 3	Empty sacks.....	Isthmian Canal Commission.	210.00		do.....	Fire extinguisher.
Gorgona.....	do	Scrap lumber.....	do.....			Sparks from locomotive.....	Line of hose.
Cristobal.....	do	Rubbish beside storehouse.....	Panama R. R.	35,000.00		do.....	Pails of water.
Gorgona.....	do	Frame platform.....	Isthmian Canal Commission.			do.....	Fire extinguisher.
Tabernilla.....	Mar. 4	Grass.....	Isthmian Canal Commission.			do.....	Smothered out.
Mount Hope.....	do	Timber.....	Isthmian Canal Commission.			Unknown.....	Fire extinguishers.
Empire.....	do	Grass.....	Isthmian Canal Commission.	12,500.00		Unknown.....	Line of hose.
Gatun.....	Mar. 5	Frame hotel.....	Panama R. R.	33,150.00		Unknown.....	Fire extinguishers.
Cristobal.....	do	Coal chute.....	Isthmian Canal Commission.			Sparks from another fire.....	Fire extinguisher and pails of water.
Panama.....	do	Grass near dwelling.....	do.....	2,145.00			Line of hose and fire extinguisher.
Corozal.....	Mar. 6	do.....	Panama R. R.	20.00		Sparks from locomotive.....	Fire extinguisher.
Mataschin.....	do	Scrap ties.....	do.....			do.....	Pails of water.
Pedro Miguel.....	do	Freight car.....	Isthmian Canal Commission.	1,056.28	252.55	Unknown.....	Line of hose.
Corozal.....	do	Frame storehouse.....	do.....	18,500.00	2.12	do.....	Do.
Gorgona.....	do	Frame machine shops.....	do.....	50,000.00		do.....	Pails of water.
Gatun.....	Mar. 7	Supply house.....	do.....	175.00		Sparks from locomotive.....	Do.
Panama.....	do	Grass.....	Panama R. R.			do.....	Do.
Tabernilla.....	do	Scrap ties.....	Isthmian Canal Commission.	176,000.00	17.50	Sparks from locomotive.....	Line of hose.
Corozal.....	Mar. 8	Frame cement shed.....	do.....			Unknown.....	Fire extinguishers.
Cristobal.....	do	Scrap rope.....	do.....			do.....	Pails of water.
Gatun.....	do	Rubbish.....	do.....			Sparks from locomotive.....	Do.
Pedro Miguel.....	do	Grass.....	Isthmian Canal Commission.			do.....	Allowed to burn itself out.
Gorgona.....	Mar. 9	Frame platform.....	do.....			do.....	Pails of water.
Mount Hope.....	Mar. 10	Grass.....	Isthmian Canal Commission.	30,000.00		do.....	Stamped out.
Toro Point.....	do	Crescent piling.....	do.....			do.....	Line of hose.
Panama.....	do	Grass.....	Isthmian Canal Commission.	20,000.00	2.00	do.....	Fire extinguishers.
Gorgona.....	do	Planing mill.....	Isthmian Canal Commission.			Unknown.....	Line of hose.
Empire.....	do	Grass.....	do.....	300.00		Sparks from locomotive.....	Do.
Gatun.....	Mar. 11	Oil tanks.....	Isthmian Canal Commission.	774.90		do.....	Fire extinguisher.
Do.....	do	Piling.....	do.....			do.....	Line of hose.
Gorgona.....	do	Rubbish.....	Isthmian Canal Commission.	25.00	20.00	do.....	Do.
Corozal.....	do	Railroad ties and wire.....	Panama R. R.	150.00	10.00	Unknown.....	Fire extinguishers.
Miraflores.....	do	Telephone pole.....	do.....	350.00	7.50	Sparks from locomotive.....	Smothered out.
Gatun.....	Mar. 13	Oil tanks.....	Isthmian Canal Commission.	75.00		do.....	Pails of water.
San Pablo.....	do	Telephone booth.....	Panama R. R.	23.00	15.00	do.....	Line of hose.
Gatun.....	do	Grass near ties.....	Isthmian Canal Commission.	43.00		do.....	Do.
Do.....	do	Frame storehouse.....	do.....	2,075.00		Spontaneous combustion.....	Allowed to burn out.
Do.....	do	Grass.....	do.....			Sparks from locomotive.....	Pails of water.
Tabernilla.....	do	do.....	do.....			Unknown.....	Line of hose.
Culebra.....	do	Grass in lumber yard.....	Isthmian Canal Commission.	8,000.00		Sparks from locomotive.....	Do.
Gatun.....	Mar. 14	Shavings.....	do.....				



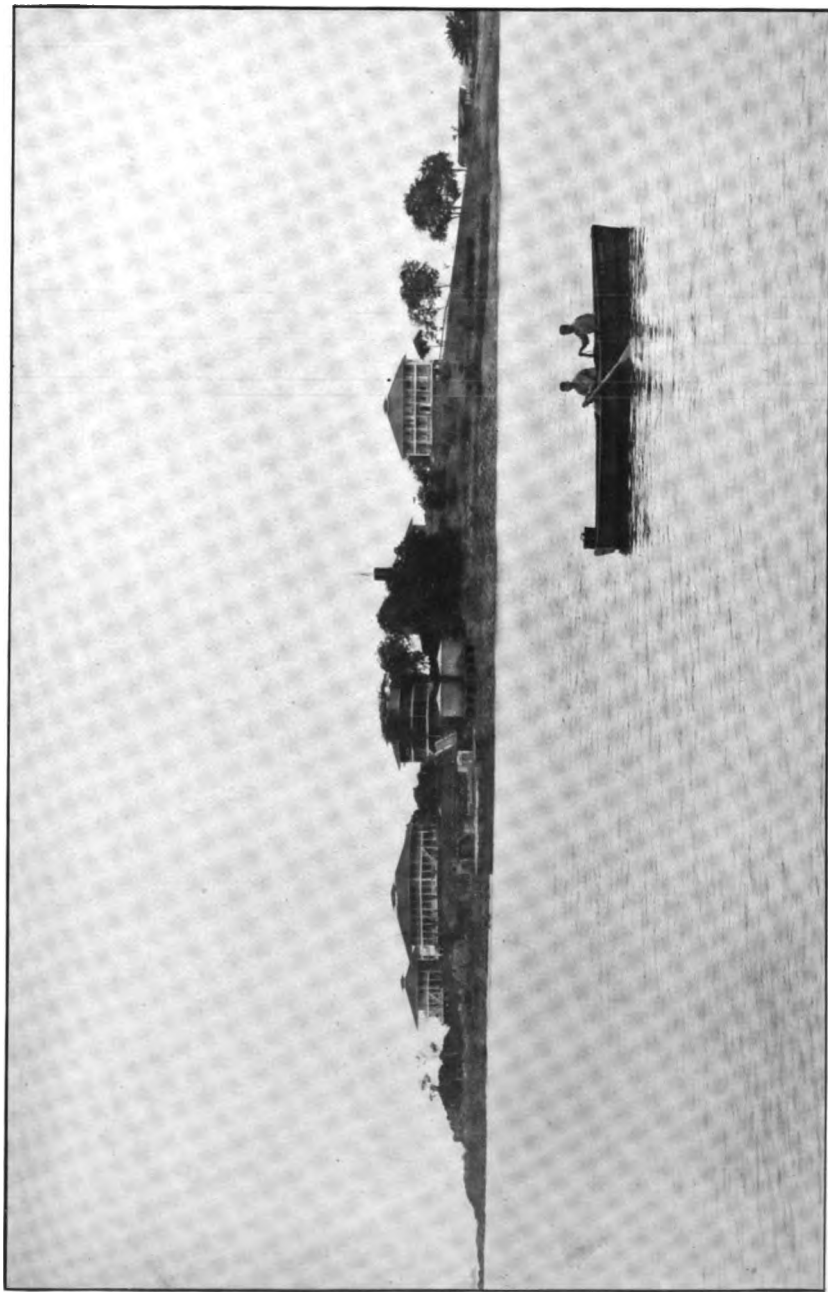
## APPENDIX IX.—DIVISION OF FIRE PROTECTION.

TABLE 51.—Detailed statement of fires during the fiscal year ended June 30, 1911—Continued.

Town.	Date.	Description.	Owner.	Total value.	Total loss.	Cause of fire.	How extinguished.
Pedro Miguel.	Mar. 14	Scrap lumber.	Isthmian Canal Commission.			Sparks from locomotive.	Line of hose.
Gorgona.	do.	Scrap t. s.	Panama R. R.			do.	Do.
Gatun.	Mar. 16	do.	Isthmian Canal Commission.			do.	Do.
Paraiso.	do.	do.	do.			do.	Do.
Corozal.	Mar. 17	Grass.	Isthmian Canal Commission.	\$9,000.00		Unknown.	Do.
Gatun.	do.	Railroad ties.	do.	153.12	\$1.75	Sparks from locomotive.	Fire extinguishers.
East Balboa.	Mar. 18	Small storehouse.	do.	1,200.00	1,200.00	Unknown.	Line of hose.
Ancon.	do.	Labor cars (3).	Panama R. R.	3,000.00	1,350.00	do.	Do.
Gatun.	Mar. 20	Grass beside drying plant.	Isthmian Canal Commission.	450.00		Sparks from locomotive.	Smothered out.
Do.	do.	Railroad ties.	do.	22.00		Hot coals.	Falls of water.
Pedro Miguel.	do.	Scrap lumber.	Private.			Sparks from locomotive.	Line of hose.
Empire.	do.	Frame dwelling.	do.	2,650.00		Kerosene lamp overturned.	Falls of water.
Balboa.	do.	Oil tanks.	Isthmian Canal Commission.	300.00		Unknown.	Do.
Ancon.	do.	Frame shed.	do.			Sparks from locomotive.	Burning article thrown out.
Paraiso.	Mar. 21	Grass.	do.	1,275.00		Sparks from locomotive.	Line of hose.
Gorgona.	Mar. 22	Frame dwelling.	Private.	10.00		Incendiary.	Burning straw removed.
Ancon.	do.	Packing boxes.	Isthmian Canal Commission.			Sparks from locomotive.	Line of hose.
Toro Point.	do.	Railroad ties.	do.	250,000.00		do.	Falls of water.
Do.	do.	Creosoted piling.	do.			do.	Line of hose.
Do.	do.	Grass.	do.			do.	Falls of water.
Pedro Miguel.	do.	Scrap lumber.	Isthmian Canal Commission.			do.	Line of hose.
Toro Point.	do.	Oil waste.	do.			do.	Falls of water.
Corozal.	Mar. 23	Grass.	do.			Unknown.	Line of hose.
Colon-Cristobal.	do.	Frame buildings.	Isthmian Canal Commission.	30,000.00	14,304.93	do.	Line of hose.
Porto Bello.	do.	Power plant.	Panama R. R.	70,000.00	3.00	Heat from smokestack.	Line of hose.
Ancon.	do.	Fals alarm.	Isthmian Canal Commission.	100,000.00		do.	Do.
Gatun.	Mar. 24	Tattle.	do.	15,000.00		Hot coals from engine.	Falls of water (assisted Panama fire department).
Toro Point.	do.	Oil waste.	Isthmian Canal Commission.			Unknown.	Fire extinguisher.
Panama.	Mar. 25	Residence and frame store-house.	Private.			do.	Line of hose.
Ancon.	Mar. 26	Scrap ties.	Isthmian Canal Commission.			Sparks from locomotive.	Do.
Bas Obispo.	do.	Grass.	do.			Unknown.	Do.
Empire.	Mar. 27	Dump.	Private.			Sparks from engine.	By Colon fire department.
Colon.	Mar. 28	Frame dwelling.	do.			Sparks from locomotive.	Line of hose.
Gatun.	do.	do.	do.	400.00	10.00	Unknown.	Do.
Tabernilla.	Mar. 29	Freight car.	Isthmian Canal Commission.			Sparks from locomotive.	Falls of water.
Empire.	do.	Scrap ties.	do.			do.	Line of hose.
Tabernilla.	Mar. 30	Shavings beside pile driver.	Isthmian Canal Commission.	6,032.60		Spontaneous combustion.	Do.
Gatun.	do.	Dump.	do.				
Gorgona.	Mar. 31						

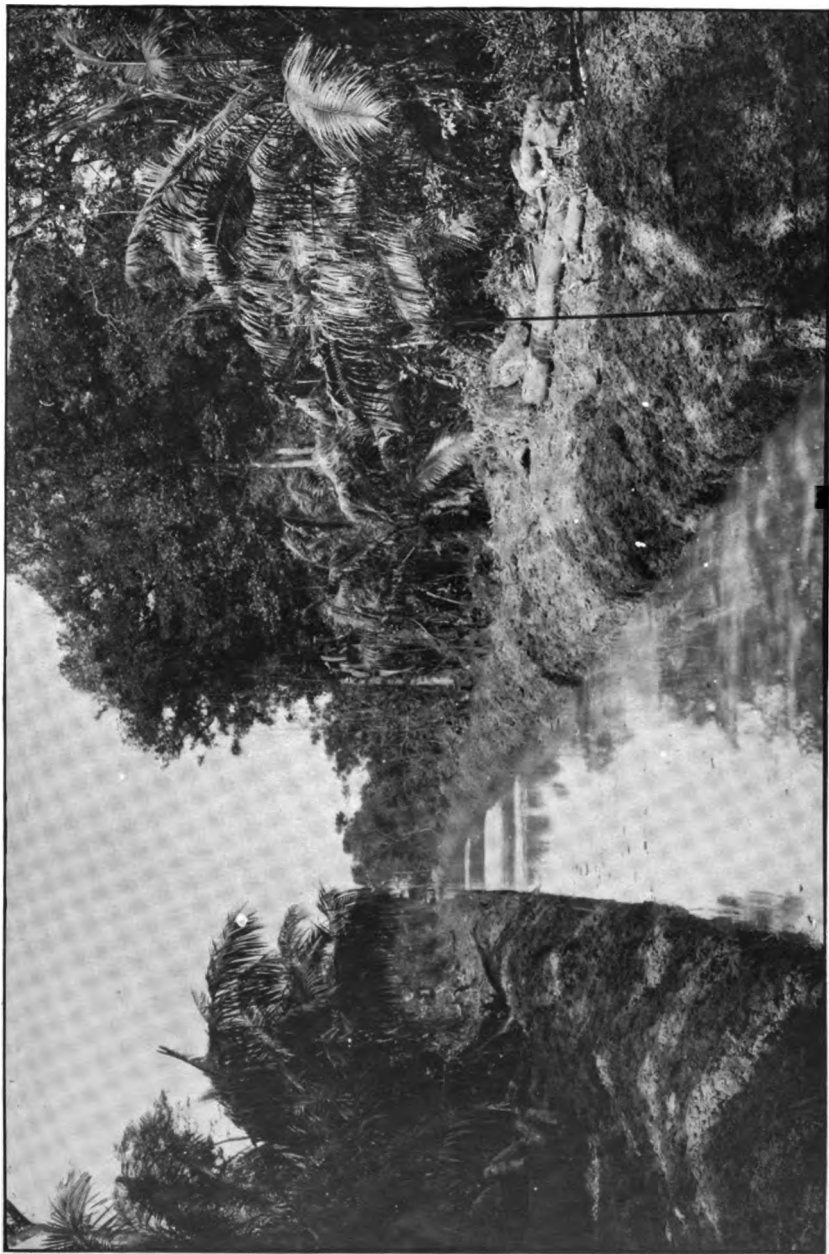
Porto Bello.	.....do.	Piling.	Isthmian Canal Commission.	700.00	Sparks from locomotive.	Pails of water.
Gatun.	Apr. 1	Shavings near timber	do.	2,627.50	do.	Fire extinguishers.
Do.	do.	Trestle.	do.	6,000.00	Hot coals from locomotive.	Pails of water.
Paraiso.	Apr. 3	Frame machine shops.	do.	14,184.73	Sparks from locomotive.	Line of hose.
Las Cascaidas.	do.	Frame coal chute.	do.	30,000.00	Spontaneous combustion.	Lines of hose.
Pedro Miguel.	do.	Frame supply house.	do.	200.00	Unknown.	Line of hose and fire extin-
						guisher.
Gatun.	Apr. 5	Cableway tunnel.	Private.	300.00	Short circuit, electric.	Line of hose.
Paraiso.	do.	Native shack.	Isthmian Canal Commission.	90.00	Defective cooking apparatus.	Outside of hydrant district.
Gatun.	Apr. 7	Timbers.	Private.	2,627.50	Sparks from locomotive.	Fire extinguisher.
Culebra.	Apr. 11	Native shack.	Isthmian Canal Commission.	120.00	Defective cooking apparatus.	Outside of hydrant district.
Mount Hope.	do.	Freight car.	Private.	950.00	Sparks from locomotive.	Fire extinguisher.
Do.	do.	Grass.	Private.	11,000.00	do.	Smothered out.
Culebra.	Apr. 17	Frame dwelling.	Isthmian Canal Commission.	34,000.00	Kerosene lamp.	Do.
Las Cascaidas.	Apr. 20	Frame coal chute.	do.		Spontaneous combustion.	Line of hose.
Mount Hope.	Apr. 21	Railroad ties.	do.		Hot coals.	Smothered out.
Panama.	Apr. 23	False alarm.	Isthmian Canal Commission.	4,000.00	Lighted match.	Line of hose.
Ancon.	Apr. 24	Frame repair shop.	Private.		Unknown.	Assisted Colon fire depart-
Colon.	do.	Frame stores and dwellings.	Isthmian Canal Commission.		Crossed electric wires.	ment.
Gatun.	do.	Repair pit.	Private.	2,600.00	Unknown.	Fire extinguisher.
Colon.	do.	Frame dwelling.	Isthmian Canal Commission.		Hot coals from locomotive.	By Colon fire department.
Gatun.	Apr. 29	Trestle.	do.	3,500.00	Sparks from locomotive.	Fire extinguisher.
Mount Hope.	May 5	Crossote near shed.	Private.		Unknown.	Allowed to burn out.
Cristobal.	May 6	Steamship Lyra.	Isthmian Canal Commission.		Explosion of torch.	Line of hose.
Pedro Miguel.	May 7	Oil beside storehouse.	Private.	700.00	Unknown.	Pails of water.
Bas Ouspo.	do.	Frame stores and dwellings.	do.	35,420.00	Sparks from brazier.	Line of hose.
Bohio.	May 15	Frame lumber.	Isthmian Canal Commission.	600.00	Unknown.	Fire extinguisher.
Gatun.	May 17	Waste lumber.	Private.		Sparks from forge.	Line of hose.
Gorgona.	May 18	Machine shops.	do.		Children playing with	Do.
Mount Hope.	May 18	Frame tenement house.	Private.	6,000.00	matches.	Pails of water.
Colon.	May 28	Frame quarantine station.	United States	20,000.00	Unknown.	Fire extinguishers.
Bafoa.	May 29	Pile driver and car.	Isthmian Canal Commission.	1,197.00	Hot coals.	Line of hose.
Gorgona.	June 7	Frame dwellings.	Private.	21,854.00	Explosion of gasoline.	Do.
Las Cascaidas.	do.	Frame dwelling.	Isthmian Canal Commission.	7,850.00	Heat from stove.	Pails of water.
Gorgona.	June 8	Frame dwelling.	do.	10,027.75	Electric light.	Do.
Colon.	June 11	Private dwelling.	Private.		Unknown.	By Colon fire department.
Bafoa.	do.	Docks, frame.	Panama R. R.		Crossed electric wires.	Line of hose.
Corozal.	June 12	Frame hotel.	(Isthmian Canal Commission.	70,000.00	Lighted cigarette.	Fire extinguishers.
Culebra.	June 13	Condemned ties.	Private.		Set afire.	Allowed to burn out.
			Panama R. R.			
				2,256,210.01		
Total for year.				53,877.44		





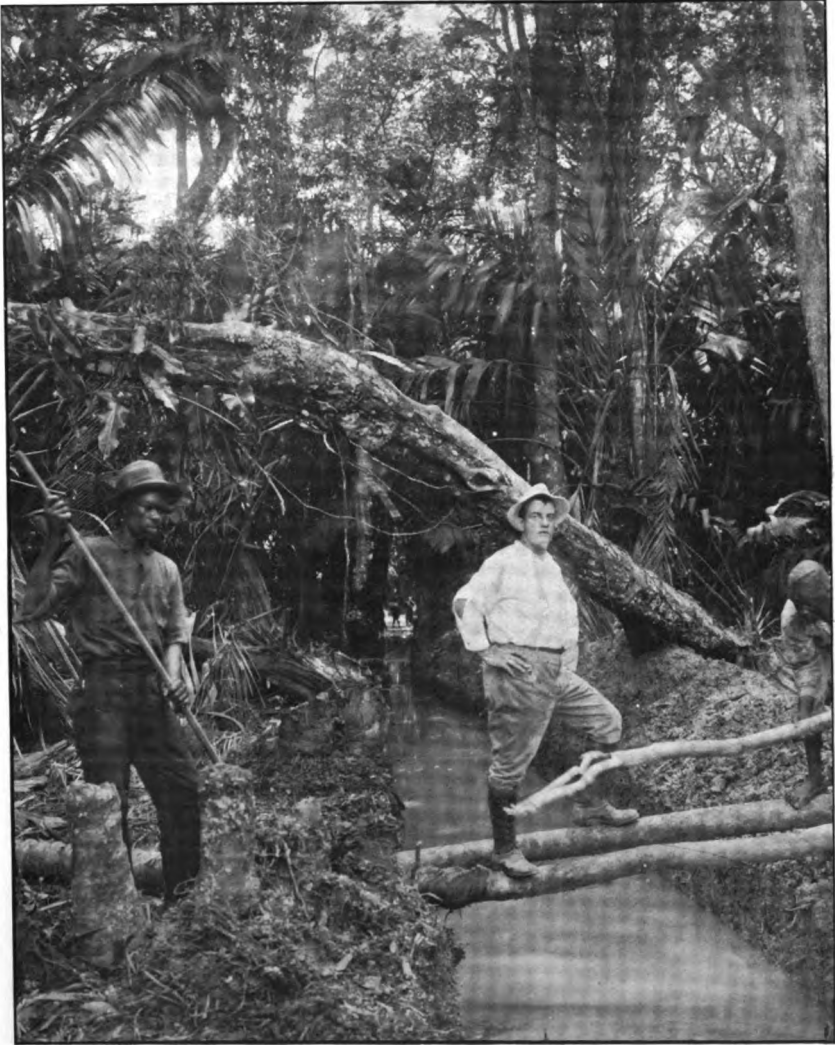
CULEBRA ISLAND QUARANTINE STATION.





DRAINAGE SYSTEM, TORO POINT. DRAIN NO. 4.





TORO POINT DRAINAGE SYSTEM. UPPER END OF DRAIN NO. 4.





## APPENDIX O.

### REPORT OF FRANK FEUILLE, HEAD OF THE DEPARTMENT OF LAW.

ISTHMIAN CANAL COMMISSION,  
DEPARTMENT OF LAW,  
*Ancon, Canal Zone, July 26, 1911.*

SIR: Complying with the directions of the acting chairman, contained in his communication dated the 16th ultimo, I have the honor to transmit herewith a report of the operations of the department of law for the fiscal year just ended, including therein the acts and doings of the counsel and chief attorney from March 10, 1910, to June 30, 1911.

#### ORGANIZATION OF THE DEPARTMENT OF LAW.

It might be well to review briefly the facts leading up to the present organization of this department, which was not effected in its entirety until the latter part of the fiscal year just ended.

The law department as now organized was established under the Executive order of January 6, 1908, and was then under the direction of the general counsel of the commission, who had his office in Washington, but visited the Isthmus from time to time. The prosecuting attorney and his assistant, under the directions of the general counsel, attended to the legal affairs on the Isthmus of the commission authorities and the Panama Railroad Co. Mr. Richard Reid Rogers resigned as general counsel some time during the first half of the fiscal year 1909-10, and the position of head of department of law became vacant.

On March 10, 1910, the writer arrived on the Zone as counsel and chief attorney for the commission and counsel and chief attorney on the Isthmus for the Panama Railroad Co., under appointment from the Secretary of War by direction of the President, and entered upon his duties at once.

The position of counsel and chief attorney was a new office, and in consequence it became necessary by appropriate legislation to invest the incumbent with sufficient authority to perform the functions theretofore belonging to the general counsel. To that end an Executive order was established by the President on April 10, 1910.

Mr. G. M. Shontz, who was then prosecuting attorney, resigned from that position, and Mr. William K. Jackson, the assistant prosecuting attorney, was appointed to take his place at request of the writer.

Due to the fact that the duties previously rendered to the commission by the general counsel in his office at Washington were

transferred to the counsel and chief attorney on the Isthmus, the work in this office increased very materially, so that it became necessary to retain an assistant prosecuting attorney to aid the counsel and chief attorney in the performance of his duties. Mr. Felix E. Porter was appointed assistant prosecuting attorney on the 11th of August, 1910, and resigned from the office on the 16th of February, 1911, when Mr. Charles R. Williams, the present incumbent, was appointed to succeed him.

On October 4, 1910, the vacancy in the office of the head of department of law was formally filled when the counsel and chief attorney was placed in charge of that department by the chairman and chief engineer, with the approval of the Secretary of War.

Land titles on the Isthmus are in an unsettled state, and the near approach of the termination of canal construction makes it imperative that measures be adopted to adjust and quiet the land situation as soon as possible. In furtherance of that purpose it was deemed advisable to create a land office, to be in charge of a land agent, under the jurisdiction of the department of law. The land office was created by Executive order of January 19, 1911.

By the terms of the order all papers, maps, records, and other documents relating to lands owned or controlled by the United States in the Canal Zone, and the land auxiliary to the canal, are to be kept in the land office. The land agent is subject to the directions of the head of department of law and is required to aid him in his investigations and adjustments of land claims. Mr. A. A. Greenman, formerly connected with the land department of the Panama Railroad, was appointed land agent on the 1st of May, 1911. And this brings us to the present organization of the department of law, which is as follows: Counsel and chief attorney, prosecuting attorney, assistant prosecuting attorney, law clerk, stenographer, messenger, land agent, land clerk, land inspector, clerk.

#### LEGISLATION.

Some very important legislation for the Canal Zone was enacted during the last fiscal year by means of Executive orders, practically all of which were drafted in this department; and just prior to the expiration of the fiscal year 1909-10, that is to say on April 16, 1910, the Executive order creating the office of counsel and chief attorney and defining the powers and duties was established. By the terms of the order he was made the legal adviser of the commission, to the chairman thereof, and to the head of department of civil administration, and is required to submit his opinion in writing when requested by the commission, the chairman, or the head of department of civil administration. I may say also that he advises the other heads of departments on matters of law when requested to do so by them. He has the direction and control of all litigation before the courts of the Canal Zone or the Republic of Panama in which the commission or the government of the Canal Zone or any of its dependencies are interested or involved, and the supervision and direction of all prosecutions of offenses against the laws of the Canal Zone, and he may inquire into criminal matters and prosecute the same in person before the courts when in his opinion it may be necessary to do so.

The order contains some substantial modifications of the pre-existing law. It authorizes the counsel and chief attorney, as well as the prosecuting attorney, the assistant prosecuting attorney, or any other counsel specially designated by the head of department of civil administration, to issue subpoenas for witnesses and examine them under oath in the investigation of criminal offenses in like manner as may be done by the judges of the courts. Previously this authority was vested alone in the prosecuting attorney.

The law requiring the prosecuting attorney to support all informations presented by him upon his affidavit to the effect that the information was based upon the testimony of witnesses heard before him was changed so as to require simply an affidavit from him that the information was based on the sworn testimony of witnesses, and it is no longer necessary that this testimony should be taken by the prosecuting attorney; but an affidavit taken by a magistrate or a notary public even would be sufficient to justify the prosecuting attorney in presenting the information, provided he deemed the evidence sufficient for him to do so.

It was not clear whether the preexisting law authorized the assistant prosecuting attorney to file an information, and the authority of the general counsel in such cases was extremely doubtful. Of course there was then no provision of law to authorize the counsel and chief attorney to present informations. Under the terms of the Executive order all of the law officers of the Zone are empowered to present informations.

Prior to the enactment of the Executive order the prosecuting attorney could not file an information in the circuit court in a misdemeanor case until after the accused had had an examining trial before the magistrate and been duly committed. In other words, practically two trials were required. In the examining trial the committing magistrate, if he deemed the evidence sufficient, bound over the accused to appear before the circuit court. Unless that was done the prosecuting officer could not proceed against the defendant, however convinced he might be of the guilt of the accused.

The practice prevails in some of the States, among them the State of California, from which our law of criminal procedure was taken. I am unable to see the wisdom of such a rule. At all events no conditions exist in the Canal Zone to require its continuance here. I am glad to say that the Executive order now authorizes the prosecuting attorney to present his information in the circuit court direct as soon as he obtains the sworn testimony of witnesses, either taken before a magistrate or before him, of a character to justify him in proceeding against the accused. Thus a much more expeditious method of prosecuting misdemeanor cases now prevails in the Canal Zone.

The law relating to the execution of processes, civil and criminal, was in considerable doubt in respect to the officers who were empowered to execute same. The Executive order has removed those doubts by expressly authorizing the peace officers of the Canal Zone to execute all writs, civil and criminal; and the order defines who are peace officers.

The changes brought about by the foregoing Executive order are so substantial that I deemed it proper to refer to it in this report, although the order was enacted before the beginning of the fiscal year 1910-11.

Conflicts between the agents of the commission engaged in canal construction and the shipping interests commenced to arise relative to the rights of the parties to the use of the canal waters. The works on the canal being of paramount importance, it was considered necessary to enact legislation to prevent interference with the canal construction, and to authorize the commission to regulate the use or passage through any of the canal channels, lakes, and waters; and to protect such channels, lakes, and waters from injury or obstruction. This has been accomplished by means of an Executive order promulgated by the President on July 25, 1910, and since its enactment the commission has established a full set of rules which govern the use of Canal Zone waters, to which the shipping interests have conformed without complaint. The rules were drawn so as to give those interests the greatest freedom of action consistent with the due progress of canal works.

In order to prevent nonresidents without interests in the Canal Zone from haling before the Canal Zone courts persons who were here transiently only, and thus deprive them of a day in court within the jurisdiction of that state or country entitled by right to hear and determine the issue between the parties, it was considered expedient to enact legislation denying the jurisdiction of our courts in all such cases. To that end an Executive order was prepared by the writer, at the instance of the head of department of civil administration, and was signed and promulgated by the President on July 28, 1910, by the terms of which parties transiently in the Canal Zone are prohibited from suing each other in the Canal Zone courts unless the cause of action is one arising within the Zone, or the parties proceeded against have property in the Canal Zone subject to the jurisdiction of those courts. The order affected pending as well as future litigation.

The civil code of Panama restricts the alienation of property by married women to very narrow limits. No married woman may alienate her separate property, although joined in the act by her husband, except by a decree of court; and this decree can be obtained only in cases where by the terms of an antenuptial contract the wife may dispose of her separate property, and in cases in which it is shown to be to the interests of the wife's estate to alienate her property. The law is so opposed to modern ideas respecting the freedom of action of married women in regard to their property rights that the rule should not have been applied to the Canal Zone. I may say, however, that the objectionable provisions were ignored in many instances, not only in the Canal Zone but in the Republic of Panama as well, although the decree of court was all essential to make the alienation by married women effective. The law was changed by an Executive order of the President, dated August 20, 1910. This order dispenses with the decree of court in all such cases, and there is substituted in lieu of the court's decree the wife's separate acknowledgment taken by an officer duly authorized to take acknowledgments. The husband must join with the wife in the execution of the deed. A provision was inserted in the order to validate all previous deeds in which there had been a failure to obtain the decree of court authorizing their execution.

During the existence of the municipal governments in the Zone taxes were assessed, levied, and collected by the municipal authorities

for the benefit of the respective local treasuries. The municipal governments were abolished by the Executive order of March 13, 1907, effective April 15, 1907, and the functions of the respective municipal officers in revenue matters were vested in the various district tax collectors. These were under the supervision of the collector of revenues, although in respect to some of their duties they seemed to be independent of that officer.

Other Executive orders followed until the law was somewhat confused, and considerable doubt existed as to the right to forfeit property to the Canal Zone government in default of bidders at tax sales. Formerly the forfeiture was made to the municipalities in such cases, in accordance with the procedure established by act 7 of the Canal Zone laws; but when the municipal governments were abolished no change was made in the law to meet the new conditions, and it was simply assumed that the right of the Zone government to the forfeiture of property in default of bidders at the sale followed by necessary implication.

In order to remedy the existing conditions and to bring harmony into the administration of the revenue laws, an Executive order was promulgated by the President on October 4, 1910, by the provisions of which the office of district tax collector was abolished and the powers and duties theretofore performed by them were vested in the collector of revenues, to be exercised by him in person or through his deputies. The Executive order also provided that property sold for taxes should be forfeited to the Zone government in default of bidders at tax sales.

An act of Congress entitled "An act relating to the use, control, and ownership of lands in the Canal Zone, Isthmus of Panama" was approved February 27, 1909. It authorizes the President to lease the land in person or through the Isthmian Canal Commission, or in such other manner as he may deem proper or convenient. The authority conferred upon the President can not be exercised until a statement is filed by the commission with the collector of revenues to the effect that the land sought to be leased will not be needed for canal construction or to be set aside as a town site.

No leases have been made under this act, but a practice of issuing leases by authority of the Secretary of War was adopted and continued until recently. The Secretary of War is authorized by the act of July 28, 1892, to lease lands under his control when not needed for public purposes for a period not to exceed five years, with the reservation that the lease may be terminated at any time. The provisions of the act were applied to the Canal Zone, and leases thereunder were executed by authority of the Secretary of War. The authority to issue leases was also exercised under the Executive order of March 13, 1907, which empowered the district tax collectors to lease Government property.

Whatever may be said as to the local applicability or inapplicability of the act of July 28, 1892, I am of the opinion that the authority of the Secretary of War to lease Government lands in the Canal Zone terminated when the act of Congress of February 27, 1909, before mentioned, was enacted, which confers that power on the President, to be exercised by him in manner and form as prescribed in the act.

In furtherance of the authority conferred on him, the President has established an Executive order, dated October 7, 1910, to provide

for the leasing of public lands by the officer in charge of the land office of the Canal Zone government, with the approval of the head of department of civil administration; but the Isthmian Canal Commission, with the approval of the Secretary of War, may designate some other officer to execute or approve such leases when in the opinion of the commission it is necessary or convenient to do so. Upon the date of the promulgation of that order public lands were in charge of the collector of revenues. Since then a land office has been created in this department and placed in charge of a land agent. Consequently this officer is now the one authorized to execute leases for public lands, with the approval of the head of department of civil administration.

In conformity with the provisions of the above-mentioned Executive order an agreement, dated May 2, 1911, was made between the canal commission, represented by the chairman and chief engineer, and the Panama Railroad Co., represented by its general superintendent, under which the land office of the Panama Railroad Co. was consolidated with that of the commission, and by which the papers, maps, records, and other documents affecting the Panama Railroad Co.'s land in the Canal Zone and the Republic of Panama may be transferred to the land office created by this order and to be kept in the custody of the land agent for the use and benefit of the Railroad Co. The arrangement so made also provides that the work previously done by the personnel of the Panama Railroad land office, including land surveys and the adjustment of land claims, shall be done by the Government land agent and other personnel of the Canal Commission. The Railroad Co. agrees to compensate the commission at the rate of \$1,000 per month for the services to be rendered in land matters.

Since the arrangement was effected the commission's land office has taken charge of all land matters belonging to the Railroad Co., except the formal execution of leases of land, which is now being done by the general superintendent under a power of attorney from the directors, and the collection of rents from the leased property, which is still in charge of the Panama Railroad collectors as formerly.

All surveying and field work connected with the Panama Railroad lands and the making of maps and charts is done by the engineers of the commission in accordance with the contract above mentioned.

The transfer of real estate or any interest therein can be effected under Panaman laws only by means of a notarial instrument duly registered in the real-estate records of the corresponding district. A very radical departure from those laws was made by the Executive order, effective April 15, 1907, which permitted lands to be conveyed by a simple memorandum in writing, signed by the grantor in the presence of two witnesses; and this memorandum was authorized to be entered in the real-estate records of the Canal Zone without being acknowledged before a notary public or other officer authorized to take acknowledgments to deeds.

The order provided for registrar's offices at Ancon, Empire, and Cristobal, the seats of the three circuit courts, the clerks of the respective circuit courts being designated as ex officio registrars of property. Deeds executed in Panama prior to the promulgation of the order, whether they affected real property or personal status, were also entitled to registration thereunder. No provision was made in

the order respecting the registration of deeds executed in Panama subsequent to its enactment.

On the 2d of February, 1911, an order was established by the President materially changing the above-mentioned order of April 15, 1907. The new order provides that no conveyance of immovable property, or of an interest therein, or of a mortgage thereon, shall be effective except by an instrument in writing, executed and delivered between the parties competent to contract and duly acknowledged in the usual form before some officer authorized to take acknowledgments under the laws of the Canal Zone. However, any instrument affecting immovable property in the Canal Zone executed before a notary public in the Republic of Colombia prior to November 3, 1903, or in the Republic of Panama after said date, and authenticated by the notary public charged with the custody of the protocol from which the copy was taken, shall be valid and effective as a conveyance of the land and interest therein conveyed and described.

Copies of final judgments of the courts of the Canal Zone and those of the courts of competent jurisdiction of the Republic of Panama rendered prior to the 26th day of February, 1904, upon compliance with certain requirements, may be admitted to record in the Canal Zone.

The order contains provisions relating to the form and manner in which the acknowledgments are to be taken and in respect to the admission of instruments and copy thereof in evidence before the courts.

The offices of registrar of property at Cristobal and Empire were abolished and one registration office established at Ancon, with the clerk of the circuit court as ex officio registrar for the entire Zone. This was done in order to concentrate in one office all of the records of private-land holdings in the Canal Zone.

An Executive order, dated May 2, 1911, was issued by the President making it a felony, punishable by imprisonment in the penitentiary for one year, for any person to return to the Zone after having been convicted and having served a sentence of imprisonment therein and thereafter deported therefrom. In addition to the punishment of one year in the penitentiary, the offender may be removed again from the Canal Zone in accordance with the laws and orders relating to deportation. The police complained that some of the deported persons were returning to the Zone, and the order was issued to prevent a continuance of the practice.

There were no laws in the Canal Zone to authorize the return of deserting seamen to their ships, and to meet the deficiency an Executive order was adopted by the President on May 6, 1911.

The order will not serve its purpose here in so far as the return of seamen deserting from foreign vessels is concerned, by reason of the fact that in such cases the return of the deserters is authorized only when there is a treaty between the country to which the vessels belong and the United States or the Republic of Panama. Chile and Peru, the two countries to the south having the largest shipping trade with the Isthmus, have no treaty at the present time with the United States on the subject of deserting seamen, nor with the Republic of Panama. Consequently the order is inoperative as to those two important South American countries.



At the request of the head of the department of sanitation an order to provide a procedure under which insane persons might be admitted into the commission's insane asylum was drafted in this office. It is an adaptation of the law of Cuba, and provides for the admission of insane patients to the asylum by judicial process, under which a period of observance of the patient must precede his final admission into the asylum. There had been no previous legislation by our Government on this subject, and the sanitary authorities were anxious that their conduct in those matters have the sanction of law. The order was signed by the President on May 10, 1911.

On May 11, 1911, the President issued an order to punish persons who ride on railroad trains without authority and without the payment of fare, in order to put a stop to the fraudulently and not uncommon practice of "stealing rides" on the Panama Railroad trains. The order provides for a punishment by fine of not less than \$5 nor more than \$20 for each offense.

The legislative assembly of Panama at its last session made a change in the rate of the tax on distillers of alcoholic spirits, and also established a new procedure for the collection of the tax. The rate of taxation was raised to 10 cents for each and every liter or fraction thereof of distilled spirits, but it was provided in the act that it should not take effect unless an agreement was obtained from the Canal Zone authorities that a like increase in the tax on distilled liquors would be made by law in the Zone. The Panaman Government was of the opinion that unless a corresponding increase was made in the Canal Zone, manufacturers or distillers of liquors in Panama would remove their stills to our territory, and doubtless they were correct in that assumption.

The commission authorities did not believe it desirable to encourage the manufacture of liquors in the Canal Zone and readily acceded to the request of the Panaman authorities that the tax in the Zone be made equal to that established by them; and to that end an Executive order was submitted to the President and approved by him on March 13, 1911. This order is to be effective August 13, 1911, upon which date the Panaman law will also begin to operate.

The Executive order imposes a tax of 10 cents on each and every liter or fraction thereof of distilled spirits produced in the Canal Zone, and in that respect conforms to the Panaman law. The order authorizes the Canal Commission from time to time to establish such rules and regulations as may be deemed necessary to execute its provisions.

These are the Executive orders which, together with a number of commission ordinances, constitute the legislative enactments promulgated during the last fiscal year.

#### ADJUSTMENT AND SETTLEMENT OF CLAIMS.

##### CLAIMS SETTLED PRIOR TO THE FISCAL YEAR 1910-11.

Although the department of law, as organized under the provisions of the Executive order of January 6, 1908, was authorized to adjust claims for damages on account of the canal works, it was not until August 6, 1908, when circular No. 193 was issued, that claims against the commission were referred to this department for attention.

Consequently the files of this office have no complete records of the claims adjusted and settled prior to the date of that circular, though some important land matters were adjusted previous to that time, such as the one arising from the acquisition of the tract of land on which the Tivoli Hotel is situated, and the tracts on which the administration building and the quartermaster's office, respectively, are located in Ancon, and the site of the old town of Gatun on which the dam is in part constructed. These land matters were adjusted and settled prior to August 6, 1908, through other departments on the Isthmus.

From August 6, 1908, until June 30, 1910, 11 joint commission awards were paid by the Government for lands taken over for canal purposes, amounting in the aggregate to \$142,515; and 3 claims were settled by the findings of the umpire, Mr. Edwin Denby, amounting to \$61,000, the joint commission having failed to agree in those cases. With few exceptions, these claims were settled during the term of office of Mr. Richard Reid Rogers as general counsel for the commission.

During the period above mentioned 16 tracts of land were acquired by the United States for canal purposes under private agreements with the landowners. These claims amounted in the aggregate to \$47,215.74, and 50 claims for damages to crops and improvements, and not involving title to land, resulting from the various activities of the commission authorities, were paid during the same time. These claims aggregate the sum of \$5,037.95. In addition, 68 claims were paid between April 8, 1910, and June 30 following, on account of a fire at Nombre de Dios, caused by a spark from a commission engine engaged in sand operations at that place. About 100 houses were burned. The 68 claims as presented amounted to a total of \$20,591.46. They were settled for \$8,796.55.

The following statement shows the total amounts paid upon claims between August 6, 1908, and June 30, 1910:

	Number.	Amount paid.
Awards of joint commission, 1908.....	11	\$142,515.00
Findings of umpire, 1908.....	3	61,000.00
Deeds for lands acquired under private contracts (Mr. Rogers and Judge Feuille)...	16	47,215.74
Claims for damages to crops, etc. (including Nombre de Dios fire claims, account fire of Apr. 8, 1910).....	118	13,834.50
Total.....	148	264,565.24

#### CLAIMS ADJUSTED AND SETTLED DURING THE FISCAL YEAR 1910-11.

The island of Margarita, in Manzanillo Bay, near Colon, and one or two other small holdings involving title to lands were acquired during the last fiscal year by the United States under agreements with the counsel for the commission. A total of \$4,250 was paid for these holdings.

One hundred and twelve claims for damages arising in connection with excavation works, surveys, road building, and other canal activities, aggregating the sum of \$4,532.37, were adjusted and settled through this office during the fiscal year which has just terminated. In addition 10 claims for damages on account of the fire at Nombre de Dios, aggregating \$436.20, were also paid during the same period.

There were 208 claims arising in the area of Lake Gatun, including the valleys of the Chagres, Gatun, and Trinidad Rivers, adjusted and paid during the fiscal year 1910-11. The amounts demanded by the claimants in these cases aggregated the sum of \$232,656. They were settled for the sum of \$46,704.50, a difference of \$185,951.50 between the amounts as claimed and the amounts accepted in settlement by the claimants.

The sum of \$33,964.85 was paid to the Caribbean Cocoanut Co. by the Panama Railroad Co. during the same period on account of damages resulting to the Cocoanut Co. from the cancellation of a lease held by them from the Railroad Co. at Toro Point. The amount above mentioned was paid by the Railroad Co. to the Cocoanut Co., upon an award of appraisers made under the terms of the lease, which provided that in the event the Railroad Co. should need the leased premises, it was authorized to cancel the lease and compensate the Cocoanut Co. for the value of the trees upon the leased land, which valuation was to be determined by the award of appraisers. The land was taken for a military reservation, and in consequence the Canal Commission has reimbursed the Railroad Co. for its outlay in paying the above award and the incidental expenses incurred in the adjustment of the claim; the total amount paid by the commission being the sum of \$34,264.85.

An award of \$740 was made to the heirs of the Mudarro estate by the joint commission in August, 1908, for 74 hectares of land to be flooded by the waters of the lake. An examination of the French records showed that the Mudarro estate had sold 100 hectares of land to the French Canal Co. and received full cash consideration for it. The final notarial deed of conveyance had not been executed, however. This office, in adjusting the award made by the joint commission with the Mudarro heirs, insisted that the conveyance of the 100 hectares to the French Canal Co. should be recognized by the Mudarro estate and should be included in the release to be made by the heirs in conveying the 74 hectares involved in the commission's award. This was agreed to and a deed was made by all of the adult heirs, not only for their interest in the 74 hectares included in the joint commission's award, but in the 100 hectares conveyed to the French Canal Co. by their ancestors as well. The adult heirs owned a three-fourths interest in the estate; the remaining one-fourth is held by minors. The adult heirs were paid the sum of \$555, being three-fourths of the joint commission's award of \$740. The one-fourth interest of the minors will be transferred to the Government as soon as a guardian of the estate of the minors shall have been appointed by the Canal Zone courts.

The joint commission awarded the sum of \$725 to the unknown owners of the Barro Colorado and Frijol Grande tracts. This sum has been returned to the disbursing officer by order of the court, inasmuch as the land covered by the award had been acquired by the United States from the rightful owners under deed of conveyance and paid for.

The following statement shows the total amounts paid on claims during the last fiscal year:

	Number.	Amount paid.
Award of joint commission, 1908, three-fourths interest in Santa Cruz award.....	1	\$555.00
Deeds for lands acquired under private agreements with parties (one of these was \$4,000 for release of interest in Margarita Island).....	2	4,250.00
Claims for damages to crops, cancellation of Caribbean Coconut Co.'s lease, etc. (including 10 Nombre de Dios fire claims, aggregating \$436.20).....	331	85,637.92
Total.....	334	90,442.92

The foregoing statements show that from August 6, 1908, to June 30, 1911, 482 claims were paid, aggregating the sum of \$355,008.16.

In most instances the claims as presented have been for excessive amounts, but no serious difficulty was encountered in effecting settlements on a reasonable basis.

There are several claims pending on account of lands taken for canal purposes in which no settlement could be arrived at with the claimants, and these will most likely await the action of a joint commission; and one or two joint commission awards remained unpaid at the end of the fiscal year.

The area of Gatun Lake to be formed covers about 164 square miles of land, half of which lies outside of the 5-mile limits established as the boundaries of the Canal Zone, and within the Republic of Panama. A large number of squatters had settled upon this area, very many of whom had lived there for a generation or more. Very many of them were found upon Panama Railroad Co.'s land, which the latter had acquired from the Government of Colombia by adjudication under its concession from that Government. In most of these cases the squatters were under the belief that they were located on public lands and entitled to claims as actual settlers under the cultivators' laws of Colombia and Panama; and the opinion had been current on the Zone until recently that these lands were in fact public, because, as it was supposed, the Railroad Co. had not obtained a definite adjudication of them from the Colombian Government. A search in the archives of the Republic of Panama, at the instance of this office, resulted in the finding of records showing that the lands in question had in fact been definitely and finally adjudicated to the Railroad Co. by the Chief Executive of Colombia, and a formal delivery of the possession made to the grantee company in accordance with the terms of the railroad's concession. And in this connection it gives me pleasure to acknowledge the courtesy extended to the head of this department by the Panaman authorities in allowing a representative of this office free access to the archives of the Republic to search for evidence respecting the land titles of the Panama Railroad Co. in the Zone.

Inasmuch as the squatters, or at least the majority of them, had been living upon the land for so many years without hindrance, it was thought equitable and expedient to compensate them for their improvements, rather than to engage in endless contentions and litigations to maintain any technical defenses that the Railroad Co. or the Government may have had against the claims. The improve-

ments placed upon the land by the squatters were of the character usually to be found in native settlements.

The following is a statement in detail of the 208 claims arising in the Gatun Lake area settled during the fiscal year 1910-11:

Location.	Owner of land.	Number.	Estimated value.	Amount paid.
Gatun River.....	Panama R. R.....	35	\$5,275.00	\$1,637.50
Trinidad River.....	do.....	62	76,495.00	19,277.00
Chagres River.....	do.....	15	33,275.00	3,430.00
Do.....	Isthmian Canal Commission.	2	900.00	300.00
Guarapo.....	do.....	19	1,382.00	775.00
Gatun River.....	Panama R. R. in Republic of Panama.	2	1,200.00	515.00
Trinidad River.....	Republic of Panama.....	73	114,120.00	20,770.00
Total.....		208	232,656.00	46,704.50

Sixty-one claims arising in the lake area were in process of adjustment and settlement at the end of the fiscal year. It is probable that a few more claims from the lake area will be presented during the current year, but the lake basin has been practically cleared of claimants.

Fifty-two claims from the lake area were declined for want of sufficient evidence to sustain them.

One hundred and thirty-two claims were declined for the reason that the lands upon which the plantations or improvements are situated had been previously purchased by the United States from private parties, and these had guaranteed the removal of all occupants therefrom.

Nineteen claims were disallowed at Lion Hill held by people who occupy the land under leases from the Panama Railroad Co., which leases were canceled on May 31, 1910.

In connection with the settlement of claims in the Lake area, measures are being taken to remove the occupants therefrom with reasonable dispatch and to prevent others from settling therein. At the suggestion of this office the contour line at the 87-foot level of the lake is being marked at various points conveniently situated, so that unauthorized persons may be required to keep above the line so marked. Under your directions the division of prisons and police will cooperate with this department in preventing intrusions in the future upon the Lake area by squatters and other unauthorized people.

#### LAW LIBRARY.

In addition to the work of drafting legislation, adjusting land claims and claims for damages, and directing litigation, both civil and criminal, of the commission authorities, this office has had considerable work of an advisory character, such as rendering opinions and reports to the chairman and chief engineer and advising the heads of the various departments upon legal matters, and especially the head of department of civil administration. The duties devolving upon the head of department of law and his assistants in this respect have been extensive and varied, and they have required considerable investigation of the laws of Colombia and Panama, as well as those

of the United States. Not a few of the questions presented to this office for opinion involved matters of international law.

When the writer entered upon his duties as counsel and chief attorney he found a very small library in this office, wholly inadequate to the needs of the department. This deficiency was most marked in respect to Colombian and Panaman law books. There were practically no statutory laws of Colombia or Panama in the office, with the exception of the civil code and one or two other enactments. A few works on Spanish jurisprudence to be found on the Zone were in the supreme court library at Ancon. However, the prosecuting attorney had made requisition for a number of American elementary legal works, which arrived during the first part of the year 1910. Since that time the library has been largely increased by the acquisition of the California and Louisiana reports, lawyers annotated reports, books of reference, encyclopedias, and law dictionaries; and through the efforts of the Washington office of the commission a large number of Government publications of a legal nature have been acquired.

Through the kindness of the secretary of the legation at Bogota we have been able to obtain by purchase a complete set of Colombian laws enacted since the beginning of that Government. There have been transferred from the supreme court library several Spanish law works of importance. The decisions of the supreme court of Bogota from 1887 to 1905 were recently acquired by purchase for the use of this library. Through the courtesy of the Panaman authorities the writer has obtained all of the legislation of the Republic of Panama which has been enacted since its independence from Colombia.

The Cuban secretary of justice was courteous enough to send the decisions of the supreme court of Cuba free of cost for the use of the law library of this department, and the same has been done by the authorities of Porto Rico. At present the department is fairly well equipped with law books to take over the investigation of practically all of the legal problems that may arise in connection with canal works. It might be well, however, to add a few more Spanish works, such as the decisions of the supreme court of Spain, and, if obtainable, some of the laws of the Latin-American countries, so that the law officer on the Zone may have a fair knowledge of the legislation of the countries in the vicinity of the canal.

#### CRIMINAL MATTERS.

The prosecuting attorney and his assistant are under the direction of the head of department of law; but inasmuch as the head of department of civil administration has the administrative supervision of the courts, the practice under which the prosecuting attorney made monthly report to the head of that department has been continued.

The prosecuting attorney and his assistant render aid to the head of this department in connection with the other work arising in this office, in addition to the service they render in criminal matters.

Three hundred and forty-three criminal cases were presented in the circuit courts during the fiscal year 1910-11, including those brought to these courts on appeal from the districts courts. The cases were distributed among the three circuit courts as follows:

Circuit court at—	
Ancon.....	74
Empire.....	217
Cristobal.....	52
<b>Total.....</b>	<b>343</b>

**The 343 cases were disposed of in the following manner:**

Convictions.....	236
Acquittals.....	79
Dismissals.....	27
Fugitive.....	1
<b>Total.....</b>	<b>343</b>

Only seven cases remained undisposed of in the three circuit courts at the end of the fiscal year. These were filed immediately before the fiscal year terminated and were disposed of at the first call of the calendar.

There has been a decrease in the number of criminal cases coming before the circuit courts as compared with the preceding years. During the year 1908-9 the number of criminal cases presented in the circuit courts amounted to 407.

During the year 1909-10 there were 399 cases presented and disposed of.

Unfortunately, there has been no decrease in the number of offenses of a serious nature, such as murder, other homicides, burglary, and forgery. These increased for the years 1909-10 and 1910-11 over the year 1908-9.

The following is a complete statement of criminal cases coming before the circuit courts for the years 1908-9 to 1910-11, inclusive:

1908-9.		1909-10—Continued.	
Convicted.....	235	Disorderly conduct.....	18
Acquitted.....	71	Embezzlement.....	15
Dismissed.....	101	Forgery.....	20
		Gambling.....	15
Total.....	407	Grand larceny.....	92
Adultery.....	26	Manslaughter.....	8
Assault and battery.....	23	Murder.....	11
Assault with a deadly weapon..	37	Miscellaneous.....	93
Burglary.....	30		
Conspiracy.....	15		399
Disorderly conduct.....	21		
Embezzlement.....	23	1910-11.	
Forgery.....	13	Convicted.....	236
Gambling.....	14	Acquitted.....	79
Grand larceny.....	91	Dismissed.....	27
Manslaughter.....	1	Fled.....	1
Murder.....	6		
Perjury.....	10	Total.....	343
Resisting arrest.....	9	Adultery.....	18
Miscellaneous.....	88	Assault and battery.....	33
		Assault with a deadly weapon..	41
	407	Burglary.....	52
1909-10.		Disorderly conduct.....	12
Convicted.....	307	Embezzlement.....	27
Acquitted.....	46	False personation.....	10
Dismissed.....	39	Forgery.....	14
Fled, insane, mistrial.....	7	Grand larceny.....	59
		Manslaughter.....	8
Total.....	399	Murder.....	2
Adultery.....	10	Perjury.....	5
Assault and battery.....	27	Resisting arrest.....	7
Assault with a deadly weapon..	36	Miscellaneous.....	55
Burglary.....	54		
			343

There has been a marked decrease in the number of grand-larceny cases as compared with the preceding years, though the number is still considerable. This is due in a large measure to the fact that theft of property over \$10 in value constitutes grand larceny. It is also grand larceny to steal property belonging to the commission or the Canal Zone government, however small the value of the property taken may be.

I am of the opinion that the unlawful taking of property should not constitute grand larceny except in cases where the property involved is of more than \$25 in value, whether the property belongs to individuals or to the Government. In cases in which the property is under the value of \$25, and especially in those cases where property of insignificant value has been taken from the commission or the Canal Zone government, a punishment by imprisonment in the penitentiary is too severe.

Considerable difficulty has been met in obtaining verdicts of guilty in jury trials on the Zone. These trials are limited to criminal cases in which the punishment imposed may be death or life imprisonment in the penitentiary. The juries are formed from among the American employees and these are very reluctant to find a verdict of guilty, especially against an American, upon the testimony of West Indians and non-Americans. It would be of very doubtful expediency to extend jury trials to all felony cases. The jury system has not given good results in the Canal Zone, and should at least be limited to capital cases, otherwise the due administration of justice would be seriously obstructed. It is earnestly recommended that the system be not extended beyond its present scope.

The district courts of the Zone have jurisdiction in civil and criminal cases similar to that exercised by the justice-of-peace courts in the United States. The prosecuting officers rarely appear in these courts, as it is only in very special cases that it is necessary for them to do so. Hence this department has not kept a record of the business that has been disposed of by the district courts; but information obtained from the files of the department of civil administration shows that the district courts have disposed of 5,858 criminal cases and 918 civil cases in the four districts during the fiscal year 1910-11.

The great bulk of the criminal cases in the Zone are against English-speaking negroes from the West Indies, and are for offenses embraced under the general head of disorderly conduct.

The natives of the Isthmus and the Spanish laborers appear in about equal numbers in the same class of offenses.

A very small number of Americans appear in criminal cases, either in the circuit or the district courts. It may be said with safety that no other colony of Americans anywhere under the flag presents a better record for law and order than that found among the Americans who are engaged in the work of building the canal.

#### PANAMA RAILROAD MATTERS.

The counsel and chief attorney for the commission is also counsel and chief attorney on the Isthmus for the Panama Railroad Co. His duties as counsel for the railroad company are quite extensive, and include the investigation and adjustment of land titles, the settlement of claims for damages, the conduct of litigation in the courts of the Republic of Panama, as well as those of the Canal Zone. A Spanish-



American lawyer is employed by the railroad company to aid the counsel and chief attorney in all matters pending in the Panaman courts. The prosecuting attorney and the assistant prosecuting attorney render assistance to the counsel and chief attorney in discharging his duties to the Panama Railroad.

A considerable portion of the work done by this office for the Panama Railroad Co. is so intimately connected with the work done for the commission that it is often difficult to draw a line between the part of the work rendered for the railroad and the part rendered for the commission. This is especially so in the adjustment of land titles and land claims.

Some considerable areas of Panama Railroad land have been taken over by the commission for canal purposes, and in respect to these many questions have arisen with claimants and squatters. This office endeavors on behalf of the railroad in all such cases to clear the lands of adverse claimants, so that the lands may be surrendered to the canal commission free from incumbrances.

A wide field is covered by this office in rendering services of an advisory nature to the railroad management. The fact that the railroad is operated under concession from the Colombian Government and within the territory of the Republic of Panama at both termini of the road necessitates considerable negotiation between the railroad management and the Panaman authorities, and in such cases the railroad company must of necessity be largely influenced by the policy of our Government toward the Government of Panama. In all of these matters this office has rendered legal assistance to the president and general superintendent and other officials of the railroad company.

The Panama Railroad Co. has been unusually free from litigation, notwithstanding its immense transportation business and the many questions that have arisen in connection with its landed interests. Claims by employees of the road on account of personal injuries are adjusted by compensating the injured employees in like manner as is done for the commission employees under the act of Congress. With few exceptions these claims are settled by the railroad management without the intervention of this office, and only on rare occasions do cases of this character appear before the courts against the railroad. There are only two cases now pending in the Canal Zone courts based on claims for personal injury, and one of these is in process of settlement at this time. There are three cases pending in the Panaman courts; two of these involve a claim by the plaintiffs for free transportation over the railroad, and the other relates to the title to a lot in the city of Panama.

It has been the policy of this office in dealing with claims against the railroad to keep in mind the fact that the company is a governmental agency, and in consequence it should be as just and impartial in its dealings with claimants as the Government is required to be in its treatment of the public. I am convinced that the very limited amount of litigation against the railroad company is due chiefly to the fact that this policy is adhered to by the railroad management on the Isthmus.

The lands acquired by the Panama Railroad Co. under its concession from the Colombian Government have been encroached upon by private persons at different places, who are asserting title to the

lands against the company by adverse possession. This office is now litigating some of these questions with the adverse claimants and is preparing to institute court proceedings against a number of these people, to the end that the issues between the railroad and these claimants may be set at rest.

#### RECOMMENDATIONS AND SUGGESTIONS.

##### REVISION OF THE LAWS.

Although some important legislation was done through Executive orders and ordinances during the fiscal year just ended, other laws are necessary so that the Zone government may be provided with adequate legislation. The existing laws in force in the Canal Zone include acts of Congress, some laws of the canal commission as originally organized, Executive orders of the President, and ordinances of the Secretary of War and of the present canal commission. In addition some few of the Spanish administrative laws have been retained, especially in connection with our revenue system and the operations of the administrative districts. These laws are to be found scattered throughout many books, pamphlets, and records of the commission. They should be compiled, revised, and added to so as to establish a simple, complete, correlated, and efficient system of legislation; one that would be applicable to the civil branch of a military organization, should the authorities at Washington deem it wise to establish such an organization here, as well as to a civil government of the Canal Zone.

The administrative laws are in need of revision in order that the duties of the respective departments may be more clearly defined and coordinated under the proper supervisory jurisdiction of the central authorities of the Canal Zone.

The law of civil procedure is quite inadequate and in some instances jurisdiction has been conferred upon the courts, and no procedure established by which the jurisdiction so conferred may be enforced. Under the circumstances the courts have been compelled to resort to the doubtful expediency of applying principles of common law and equity as understood and recognized in the States of the Union, in order to provide the necessary machinery to make their jurisdiction effective. The deficiency in the law can be easily remedied by reenacting the law of civil procedure, with such additional provisions as may be necessary to make a well-rounded out system under which judicial matters may be tried and definitely determined in the courts.

The Penal Code and Law of Criminal Procedure are also in need of attention, but a few amendments would suffice to supply the deficiencies in the laws as they now exist.

The Civil Code, Code of Commerce, and other laws which have been continued over from the Republic of Panama to the Canal Zone government may be allowed to remain without material changes. It is believed that the Panaman laws now in force in the Zone, affecting the people in their civil relations, such as the Civil Code and the Code of Commerce, are better adapted to local conditions than any laws that might be introduced from some one of the States of the American Union.

It has been suggested that as the Zone is American territory, American laws should be established in their entirety to the exclusion

of Spanish laws that have passed to us with the change of sovereignty. It is the opinion of the writer that such a radical change would result in more harm than benefit. The relations between the people of the Canal Zone and those of the Republic of Panama are too close to justify a fundamental departure from the laws of the Republic. Harmony can be best preserved by maintaining the civil laws we now have as far as that can be done consistently with the interests of our own people on the Zone.

#### JUDICIARY.

In connection with the revision of the Canal Zone laws it might be well to consider the reorganization of the courts. In my judgment the present judicial system is cumbersome and expensive. The business transacted by the three circuit courts is not sufficient to keep one active judge constantly employed, much less three of them. If one circuit court were substituted for the three now existing, there would be but one court organization and a corresponding decrease in expenses would follow, and it is believed that the judicial business of the Zone now coming before the circuit courts would be transacted with more dispatch if concentrated in one court.

It would not be advisable to have one circuit court only unless Congress should authorize appeals to be taken from the decisions of that court to some appellate court in the United States, preferably the circuit court of appeals of the fifth circuit located in New Orleans. That court entertains appeals from the Federal courts in the Gulf States, all of which States are more or less influenced by principles of the civil or Roman law which have passed to them from the French and Spanish Governments which preceded our own State governments now in existence there. This is especially so in regard to the State of Louisiana, which has a Civil Code substantially the same as that of Panama.

There are at present five district judges with jurisdiction equal to that of a justice of the peace in the States of the Union. One of these five judges is a senior judge, who acts as a supernumerary to supply the temporary vacancies in the respective district judgeships during the absence of the regular incumbents upon vacation or from any other cause. The senior judge also presides at conferences of the district judges of a business character.

The four district courts disposed of 5,858 criminal cases during the last fiscal year, or on an average of about 5 criminal cases per day for each court, allowing 300 working days to the year. And they have disposed of about 1,000 civil cases during that time, which meant an average of less than one case per day for each one of the courts for the same number of working days. It is quite common for police courts to dispose of 25 or 30 or more cases in one day. This was done in the municipal courts of Porto Rico in the cities of San Juan and Ponce, where the business coming before those courts was quite large.

The district courts might be reduced to three, one to be at Cristobal, another at Ancon, and the third at some intervening place between those two points. The belief that three district courts could handle the business is entertained by some of the district judges as well as by the writer. It may be added that as soon as the canal work is completed—that is to say, within the next year or two—there will be

a very great reduction in the force employed in canal construction. The result will be to depopulate the Canal Zone by one-half or more as compared with its present population, and in consequence the business done by the courts of a criminal nature will be correspondingly diminished; especially as the reduction of force will result in the removal from the Canal Zone of a very large West Indian element, which now causes the bulk of the criminal business before the courts.

Should a bill now pending before Congress to provide a judiciary for the Canal Zone and for other purposes, or a similar one, fail of enactment, so that the reorganization of the Zone judiciary must be made by Executive order, if such a reorganization is determined upon, a readjustment might be had by providing a judiciary of three circuit judges, instead of the present system with its three circuit judges and five district judges. The three circuit courts under the proposed system could be given jurisdiction in all civil and criminal matters without limitation, in order to hear and determine not only the cases now tried by the circuit courts but those coming within the jurisdiction of the district courts as well as now organized. The three circuit judges could discharge all of the judicial business of the Zone without delay, especially after the reduction of force to follow the completion of the canal.

Under the new system the three circuit judges could be authorized to sit in banc as a supreme court to hear appeals taken from the trial courts. In order to prevent an excessive number of appeals, the right to obtain a review of a case by the supreme court need not be granted in police cases, unless the punishment imposed exceeded a fine of a certain amount or imprisonment in excess of a certain period of time.

It may be said that tribunals of the dignity of circuit courts should not be required to try ordinary police cases; but an answer to that objection is found in the fact that the United States district courts, whose high character and dignity is universally recognized, have been required to try petty cases under the Federal statutes, and this is especially so in respect to those Federal courts which hold sessions in districts including military and other Federal reservations. These courts are given jurisdiction to try and determine petty offenses when committed within any of the above-mentioned reservations.

The revision of the laws here suggested could be made by a committee consisting of three members to be appointed by competent authority with power to call upon all of the departmental chiefs for suggestions in respect to the changes desired in the respective branches of the service. The administrative laws might be the first to receive attention, and then the other laws could be taken up and revised in their turn.

However, it is suggested that this general work of revision be deferred in order to ascertain whether Congress will enact a law to establish a system for the government of the Canal Zone at its next session. The revision can then be made to conform to the purposes of the act of Congress.

A law requiring the inspection of hulls and boilers of steamships engaged in trade with the Canal Zone is very much needed. There are a number of steamers plying between the Zone and the ports of Latin America that have not been duly inspected under Government

authority anywhere in several years. The shipping laws of the United States require the inspection of hulls and boilers at least once every year, and these laws should be substantially applied to the Canal Zone. If this is not done and this important subject is not covered by appropriate legislation, the responsibility would rest upon our Government in the Zone in the event of an accident with fatal consequences to any of the steamships, resulting from a defective hull or boiler. An Executive order has been drafted and submitted to the authorities at Washington containing provisions similar to those found in the shipping laws of the United States, and it is to be hoped that it will be approved and promulgated as a law of the Canal Zone, as its enactment would prove of material benefit to the traveling public and the shipping interests.

#### LAND SYSTEM.

The land laws of Colombia relating to actual settlers and the adjudication of public lands to individuals or corporations for various purposes ceased to have force and effect in the Canal Zone upon the change of sovereignty. These laws, being political in their nature, could have no application here, so as to impose an obligation upon our Government to continue to recognize the claims of actual settlers or any other claims under the Colombian land laws arising subsequent to the acquisition of the Zone by the United States.

Efforts have been made by the head of this department to obtain information in regard to the history of the many tracts of land situated within the Zone lines and claimed by private persons, but without success except in regard to a very few tracts. Practically none of the lands held by private persons in the Canal Zone rest upon an express grant from the Government. The owners, with very few exceptions, rely upon long-continued possession to sustain their claims of ownership in the lands.

There are few boundary lines properly established on the ground between the many private land holdings, and this condition exists to a considerable extent in regard to the lands belonging to the United States acquired from the French Canal Co. as well as those acquired from the Republic of Panama under the treaty.

The Panama Railroad Co. has considerable land in the Canal Zone, acquired by virtue of its concession from the Colombian Government and also by purchase. These lands in the majority of cases had not been definitely located on the ground until recently. During the last fiscal year the tracts in question have been surveyed upon the ground and plotted at the instance of this office, in order that the proper data upon which to base judicial proceedings on behalf of the Railroad Co. might be obtained.

The condition of land titles in the Zone and the confusion in regard to boundaries of various tracts requires the immediate attention of the authorities. A complete survey of the Zone is necessary. The boundary lines of all of the Government lands as well as those of the Panama Railroad Co. should be run out upon the ground and plotted, and the same should be done in respect to private holdings. Whether in the latter cases it is more expedient that this be done at the expense of the private owners or that of the Government is a ques-

tion of policy to be resolved by those higher in authority. But it is suggested that the work should be done at once, even at the expense of the Government.

In connection with the land survey it is suggested that a transcript from the real-estate records of the cities of Panama and Colon of all the deeds affecting lands in the Canal Zone be obtained. This expense should be borne by the Canal Zone government. The practice of transcribing real-estate records from one jurisdiction to another is commonly followed in the United States, especially when a new county is carved from an old one the authorities of the new county ordinarily provide for the transcribing of the real-estate records from the old county of all titles affecting lands in the new county. It seems that the same method should be pursued here. The matter could be taken up informally with the Panaman Government and its consent obtained to make the transcription.

Efforts have been made through the State Department at Washington to obtain copies of all maps and documents in the archives of Bogota affecting lands in the Canal Zone, but without success, though our minister at Bogota applied for the documents to the Colombian authorities.

It would greatly aid the commission authorities if Congress would authorize them to adjust boundary questions with private persons owning lands contiguous to those belonging to the United States. It is not believed that such a procedure could be made compulsory, inasmuch as claimants have a right under the canal treaty to submit the issues between the Government and them to a joint commission for determination. But many of the persons claiming private lands would be willing to an adjustment of the boundary lines by agreement, and in those cases the work could be done and an agreement reached in a far more expeditious manner than if the issues were submitted to a judicial tribunal. A draft of a bill for submission to Congress embodying these suggestions was prepared in this office recently and sent to the chairman and chief engineer.

#### CONSOLIDATION OF THE PANAMA RAILROAD WITH THE CANAL COMMISSION.

The near approach of the completion of the canal has brought up the question whether the Panama Railroad Co. should be continued as an independent entity after the canal is completed. There would be no legal objection to a consolidation of the railroad with the canal system, and certainly considerable economy in the administration of the railroad would result from the consolidation. While being utilized as an aid to the canal the railroad could also be employed as an instrumentality of commerce, and the revenue thus derived would be sufficient to pay the operating expenses of the road, and the maintenance as well.

The change would probably mean the abandonment of the steamship service now rendered to the public by the Railroad Co., as the needs of canal operations would not require so large a number of steamers as are now operated by the Railroad Co. The necessity for the steamship line would no longer exist, except perhaps as to one or two steamers.

In order that the railroad might be operated by the canal authorities direct a dissolution of the corporation would be necessary. This could take place by vote of the stockholders of the road or by an act of Congress; and it would require an act of Congress to place the road under the control and management of the Canal Zone authorities. Appropriate legislation would be needed to permit those in control of the road to enter into commercial contracts for transportation and to use the income to meet the expenses of maintenance and operation. The law might provide also for the application of the surplus earnings of the road to the payment of the expenses of canal operation and to the maintenance of any local government that may be established.

Several consequences affecting the property of the Panama Railroad would follow from a dissolution of the corporation. The railroad under its concession from the Colombian Government acquired certain lands needed in the construction and operation of the road and for other purposes. These lands were to revert to the Colombian Government upon the expiration of the concession. Under the treaty between the Republic of Panama and the United States these reversionary interests of the Panaman Republic in the railroad passed to the United States.

In conclusion, it is but just to the personnel of this department to say that each and every member of the force has rendered faithful and efficient services to the Government at all times; and this may be said especially of the prosecuting attorney and the land agent, through whose well-directed efforts in investigating and adjusting the many claims presented by squatters living in the Gatun Lake area large sums of money have been saved to the Government, as is shown by the great difference in amount between the claims as presented and as settled and paid for by the Government.

Respectfully submitted.

FRANK FEUILLE,  
*Head of the Department of Law.*

Col. GEORGE W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

## APPENDIX P.

### REPORT OF COL. W. C. GORGAS, MEDICAL CORPS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, CHIEF SANITARY OFFICER, HEAD OF THE DEPARTMENT OF SANI- TATION.

#### ISTHMIAN CANAL COMMISSION, OFFICE OF THE CHIEF SANITARY OFFICER, *Ancon, Canal Zone, July 21, 1911.*

SIR: I have the honor to submit herewith the annual report of the sanitary department for the fiscal year ending June 30, 1911.

Figures as to health conditions during the past fiscal year, as compared with those for other fiscal years since 1906, are shown below:

#### WHITE EMPLOYEES.

Years.	Average number.	Total deaths.	Annual average per 1,000.
1906-7.....	7,727	123	15.93
1907-8.....	12,068	185	15.34
1908-9.....	12,299	147	11.95
1909-10.....	11,954	108	9.03
1910-11.....	12,891	129	10.01

#### BLACK EMPLOYEES.

1906-7.....	24,587	1,150	45.94
1907-8.....	30,999	604	19.48
1908-9.....	31,962	383	11.96
1909-10.....	38,581	440	11.40
1910-11.....	36,238	428	11.81

#### ALL EMPLOYEES.

1906-7.....	32,314	1,273	39.41
1907-8.....	43,067	789	18.32
1908-9.....	44,261	530	11.97
1909-10.....	50,535	548	10.84
1910-11.....	49,129	557	11.34

The same is shown in the combined population of the cities of Panama, Colon, and the Canal Zone, the latter including, in addition to employees, the civil population.

Years.	Average population.	Total deaths.	Annual average per 1,000.
1906-7.....	87,215	3,670	42.08
1907-8.....	112,002	3,100	27.67
1908-9.....	127,362	2,807	22.04
1909-10.....	144,614	2,735	18.91
1910-11.....	154,255	3,409	22.10



Comparative figures for white employees from the United States for the past four fiscal years are:

Years.	Average number.	Deaths, all causes.	Annual average per 1,000.
1907-8.....	5,036	41	8.14
1908-9.....	5,126	42	8.19
1909-10.....	5,573	31	5.56
1910-11.....	6,163	33	5.35

The comparative figures for all Americans on the Canal Zone, including employees and the members of their families, as well as casals not in any way connected with the work, are:

Years.	Average population.	Total deaths.	Annual average per 1,000.
1907-8.....	7,040	59	8.38
1908-9.....	8,105	64	7.89
1909-10.....	9,198	54	5.87
1910-11.....	10,500	58	5.52

The number of deaths from violence for all employees for this fiscal year was 178, as against 174 for 1909-10.

Deaths among employees from diseases which might be called tropical and including lobar pneumonia and pulmonary tuberculosis are as follows:

Diseases.	1906-7	1907-8	1908-9	1909-10	1910-11
Dysentery.....	59	35	10	13	18
Malaria.....	205	98	47	45	41
Pneumonia.....	466	175	60	77	83
Black-water fever.....	6	13	22	6	9
Liver abscess.....	5	11	8	6	8
Pulmonary tuberculosis.....	6	60	38	51	28

The record of deaths from typhoid fever among employees is for 1906-7, total 95; 1907-8, white 4, black 38, total 42; 1908-9, white 2, black 17, total 19; 1909-10, white 1, black 15, total 16; 1910-11, white 1, black 8, total 9.

During the past year and including sick in hospitals, sick camps, and quarters there was a daily average of 24.77 sick out of every 1,000 employed, as against 23.01 for 1909-10, and 23.49 for 1908-9.

During the year 134 deportations were accomplished—104 for disease and 30 for injuries.

The cost of subsistence per patient per day for the year was \$0.25, while the entire cost of treatment per patient per day was \$1.16, and deducting the revenues received from patients not entitled to free treatment the net cost per patient per day was \$0.96.

Very respectfully,

W. C. GORGAS,  
Chief Sanitary Officer.

Col. GEO. W. GOETHALS, U. S. Army,  
Chairman and Chief Engineer, Culebra, Canal Zone.

## VITAL STATISTICS, FISCAL YEAR 1910-11.

*Deaths of employees of the Isthmian Canal Commission and Panama R. R. Co.*

Color.	Average number of employees.	Total number of deaths from—			Annual death rate per 1,000.		
		Disease.	Violence.	All causes.	Disease.	Violence.	All causes.
White.....	12,891	70	59	129	5.43	4.58	10.01
Colored.....	36,238	309	119	428	8.53	3.28	11.81
Total.....	49,129	379	178	557	7.72	3.62	11.34

*Deaths in the cities of Panama and Colon and the Canal Zone.*

Places.	Population.	Deaths.	Annual average per 1,000.
Panama.....	46,214	1,523	32.96
Colon.....	19,801	539	27.22
Canal Zone.....	88,240	1,347	15.27
Total.....	154,255	3,409	22.10

NOTE.—The figures relating to the number of employees are compiled from the pay rolls of the different months of the year. The population and deaths as given for the cities of Panama, Colon, and the Canal Zone, include employees and civil population.

Total admissions of employees to hospitals and sick camps including those sick in quarters..... 46,482  
 Average per thousand of admissions of employees to hospitals and sick camps, including those sick in quarters..... 944

*Deaths by age, color, and sex.*

Ages.	White.		Colored.		Yellow.		Total.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Under 1 year.....	78	61	532	368	1	2	611	431
1 to 4 years.....	22	24	138	134	2	2	162	160
5 to 10 years.....	2	3	24	23	.....	.....	26	26
11 to 20 years.....	13	5	107	55	2	.....	122	60
21 to 30 years.....	77	16	412	166	12	.....	501	182
31 to 40 years.....	71	19	258	104	12	.....	341	123
41 to 50 years.....	59	9	174	68	10	.....	243	77
51 to 60 years.....	25	6	90	41	3	.....	118	47
61 to 70 years.....	7	2	36	22	2	.....	45	24
71 to 80 years.....	4	4	17	7	1	.....	22	11
81 to 90 years.....	1	4	5	3	.....	.....	6	7
91 to 100 years.....	1	1	.....	1	.....	.....	1	2
Unknown.....	6	4	44	6	1	.....	51	10
Total.....	366	158	1,847	998	46	4	2,219	1,160

*Deaths by nationality.*

Nations.	Employ-ees.	Nonem-ployees.	Total.	Nations.	Employ-ees.	Nonem-ployees.	Total.
Africa.....		1	1	Italy.....	11	12	23
Antigua.....	14	9	23	Jamaica.....	107	561	668
Argentina.....		1	1	Martinique.....	26	56	82
Australia.....	1	1	2	Mexico.....		6	6
Austria.....		1	1	Montserrat.....		11	16
Barbados.....	160	238	398	Nassau.....	5		5
Belgium.....		1	1	Nevis.....	1	1	2
Bolivia.....		1	1	Nicaragua.....	3	4	7
Brazil.....	1		1	Norway.....	2	1	3
Bulgaria.....	1		1	Panama.....	17	1,415	1,432
Canada.....		2	2	Peru.....	2	4	6
Chile.....		1	1	Porto Rico.....		3	3
China.....		49	49	Portugal.....	2		2
Colombia.....	14	134	148	San Salvador.....		1	1
Costa Rica.....	2	9	11	St. Croix.....		1	1
Cuba.....	1	8	9	St. Domingo.....	1	1	2
Curaçao.....		4	4	St. Kitts.....	5	4	9
Demerara.....	2	2	2	St. Lucia.....	6	58	64
Denmark.....		2	2	St. Martin.....	1		1
Dominica.....		2	2	St. Thomas.....		3	3
Ecuador.....	2	10	12	St. Vincent.....	4	2	6
England.....		8	8	Spain.....	57	55	112
Fortune Islands.....	16		16	Sweden.....		2	2
France.....	3	15	18	Syria.....		2	2
Germany.....		6	6	Trinidad.....	5	25	30
Greece.....	11	3	14	Turks Island.....		1	1
Grenada.....	13	29	42	Turkey.....		1	1
Guadeloupe.....	20	14	34	United States.....	34	39	73
Guiana, British.....		2	2	Venezuela.....	1	2	3
Haiti.....	3	3	6	West Indies.....	1	19	20
Honduras.....		1	1	Unknown.....			
Ireland.....		1	1				
India.....		1	1	Total.....	557	2,852	3,409

*Causes of deaths of employees of the Isthmian Canal Commission and Panama R. R.*

Causes of death.	White.	Colored.	Total.	Causes of death.	White.	Colored.	Total.
<b>DISEASE.</b>				<b>DISEASE.</b>			
Alcoholism, acute and chronic.....	2		2	Infection of unknown origin.....	1	7	8
Anæmia.....		1	1	Intestinal obstruction.....		2	2
Anæurism.....		1	1	Leuchæmia, lymphatic.....	1		1
Apoplexy.....	4	5	9	Liver.....			
Appendicitis.....	1	2	3	Abscess of.....	2	6	8
Brain, softening of.....		1	1	Hydatid tumor of.....	1		1
Brain, tumor of.....	1		1	Lungs, gangrene of.....		2	2
Cancer and other malignant tumors of buccal cavity.....	1		1	Measles.....		1	1
Cancer and other malignant tumors of stomach and liver.....	1	2	3	Meningitis.....			
Cancer of organs not specified.....		1	1	Pneumococcus.....		2	2
Cerebro-spinal fever.....	1		1	Tuberculous.....		3	3
Diabetes.....		1	1	Simple.....		3	3
Dysentery.....	2	4	6	Nephritis.....			
Amoebic.....		2	2	Acute.....	1	6	7
Clinical.....		10	10	Chronic.....	5	29	34
Diarrhea and enteritis.....		3	3	Other diseases of the kidneys and adnexa.....	1		1
Emphysema, pulmonary.....		1	1	Other forms of mental alienation.....		1	1
Epilepsy.....		3	3	Other nonvenereal diseases of male genital organs.....		1	1
Fever.....				Other tumors (Lymphoma).....		1	1
Hæmoglobinuric.....	6	3	9	Peritonitis, simple.....		2	2
Malaria.....	1	4	5	Pleurisy.....		1	1
Malaria, estivo-autumnal.....		13	13	Pneumonia.....	1	13	14
Typhoid.....	1	8	9	Pneumonia, lobar.....	10	59	69
Gastritis, acute.....		1	1	Pyæmia.....	3	4	7
Heart, organic disease of.....	4	9	13	Pyæmia and septicæmia, pneumococcal.....		3	3
Hæmorrhages, other.....		1	1	Pyelo-nephrosis.....		1	1
				Septicæmia.....	2	1	3
				Septicæmia, purulent infection and.....		1	1

*Causes of deaths of employees of the Isthmian Canal Commission and Panama R. R.—*  
Continued.

Causes of death.	White.	Colored.	Total.	Causes of death.	White.	Colored.	Total.
<b>DISEASE—continued.</b>				<b>VIOLENCE.</b>			
Splenic anæmia .....	1	.....	1	Accidental trauma-			
Syphilis.....	2	.....	2	tisms, various.....	11	23	34
Stricture of urethra.....		1	1	Burns and scalds.....	.....	1	1
Tetanus.....		2	2	Drowning, accidental.....	4	19	23
Tuberculosis:				Dynamite explosions.....	5	5	10
Abdominal.....		3	3	Electric shock.....	3	5	8
Disseminated.....		20	20	Homicides.....	3	4	7
Millary.....	1	2	3	Railroad accidents.....	28	58	86
Pulmonary.....		28	28	Suicides.....	2	.....	2
Tuberculosis of genito-				Other acute poisonings.....	1	1	2
urinary organs.....		1	1	Other external violence.....	2	3	5
Ulcer, duodenal.....		2	2				
Undiagnosed.....		6	6	Total.....	129	428	557

*Deaths of white employees from the United States.*

Names.	Division.	Time on Isthmus.	Age.	Cause of death.
<i>July, 1910.</i>				
Amos, Lamont.....	Atlantic division.....	1 year.....	Yrs. 60	Bright's disease.
<i>August, 1910.</i>				
Hobart, Joseph.....	Engineering.....	7 weeks.....	42	Accidental trauma (dynamite).
Jackson, John.....	do.....	13 months.....	13	Railroad traumatism.
Ridley, Arthur G.....	do.....	4 years 2 months.....	38	Fall from cement wall.
Tinsley, Elias C.....	Panama R. R.....	4 years.....	46	Railroad traumatism.
Tafel, Harry.....	do.....	4 months.....	24	Poisoning by acid.
<i>September, 1910.</i>				
Coit, John J.....	Transportation department.....	.....	36	Railroad traumatism.
Haven, Fred B.....	Mechanical department.....	5 years.....	33	Syphilis of cerebellum.
Siegle, William.....	Atlantic division.....	7 months.....	27	Traumatism by machines.
<i>October, 1910.</i>				
Halstead, W. S.....	Chairman's office.....	4 years.....	28	Amoebic abscess of liver.
Lynch, James.....	Pacific division.....	6 months.....	38	Acute alcoholism.
Schaberle, John A.....	Chairman's office.....	2 years.....	33	Homicide by firearms.
<i>November, 1910.</i>				
Tate, Dexter.....	Quartermaster's department.....	5 years.....	43	Suicide by firearms.
<i>December, 1910.</i>				
Brady, Walter H. H.....	Sanitary department.....	5 years 7 months.....	32	Traumatism by fall.
Crawford, John.....	Mechanical division.....	5 years.....	51	Chronic nephritis.
Dabbs, John S.....	Atlantic division.....	16 months.....	21	Staphylococcus septicæmia.
Evans, J. D.....	Panama R. R.....	18 months.....	23	Splenic anæmia.
Murphy, A. R.....	Mechanical division.....	44 years.....	56	Sarcoma of right parotid gland.
<i>January, 1911.</i>				
Alleman, L. H.....	Central division.....	2 years.....	48	Traumatism by fall.
Frank, Edwin E.....	Atlantic division.....	94 months.....	27	Suicidal drowning.
Logan, A. C.....	Panama Railroad Co.....	4 years.....	50	Carcinoma of gall bladder and ducts.
White, Louis R.....	Atlantic division.....	5 years.....	35	Railroad traumatism.
<i>February, 1911.</i>				
Allison, E. H.....	Transportation department.....	44 years.....	50	Chronic nephritis.
Day, Henry C.....	Atlantic division.....	39 months.....	37	Aortic insufficiency.
Le Rue, Alex.....	McClintic-Marshall Co.....	17 days.....	27	Railroad traumatism.
<i>March, 1911.</i>				
Cleary, J. R.....	Mechanical division.....	5 months.....	24	Railroad traumatism.
Hobrough, John M.....	Atlantic division.....	34 months.....	23	Other external violence.
Marotte, Henry J.....	do.....	22 months.....	44	Traumatism by machine.

*Deaths of white employees from the United States—Continued.*

Names.	Division.	Time on Isthmus.	Age.	Cause of death.
<i>April, 1911.</i>				
Notte, John S. ....	Panama R. R. ....	6 years. ....	Yrs. 42	Pyæmia.
<i>May, 1911.</i>				
Harlow, James B. ....	Atlantic division. ....	5 years. ....	36	Chronic nephritis.
O'Neill, Ambrose. ....	Fire department. ....	10 months. ....	34	Accidental drowning.
Schofield, R. H. ....	Pacific division. ....	7 months. ....	25	Acute nephritis.
<i>June, 1911.</i>				
Dennis, L. R. ....	Atlantic division. ....	7 years. ....	41	Hæmoglobinuric fever.

*Deaths of white women and children from the United States.*

Names.	Time on Isthmus.	Age.	Cause of death.
<i>July, 1910.</i>			
Arthur, Guy Everard. ....	19 months. ....	19 months. ....	Malaria.
Reidman, Karl. ....	18 months. ....	3 years. ....	Diphtheria and nephritis.
Thompson (infant). ....	1 day. ....	1 day. ....	Premature birth.
<i>August, 1910.</i>			
Albright, Marion Ruth. ....	16 months. ....	19 months. ....	Pneumonia.
Murwin, Mrs. W. H. ....	.....	26 years. ....	Burns—explosion of alcohol lamp.
<i>September, 1910.</i>			
Scribner, L. May. ....	3 years. ....	38 years. ....	General peritonitis.
<i>October, 1910.</i>			
Harbinson, J. ....	10 months. ....	34 years. ....	Acute infectious jaundice.
<i>November, 1910.</i>			
Butz (infant). ....	1 hour. ....	1 hour. ....	Atelectasis, congenital.
Gibson, Beale M. ....	4 years. ....	31 years. ....	Asphyxiation (accidental).
<i>December, 1910.</i>			
Smith, Mrs. R. ....	3 years. ....	32 years. ....	Burns.
Woodburn, Mrs. Effie. ....	6 months. ....	42 years. ....	Acute nephritis.
<i>January, 1911.</i>			
Milford (infant). ....	1 day. ....	1 day. ....	Premature birth.
<i>February, 1911.</i>			
Petre, Mrs. Margaret. ....	3½ years. ....	71 years. ....	Organic heart disease.
Strobridge, Lavinia. ....	do. ....	45 years. ....	Mitral stenosis and insufficiency.
<i>March, 1911.</i>			
Calahan, Mrs. Margaret. ....	9 months. ....	81 years. ....	Chronic nephritis.
Clark, Mrs. E. B. ....	do. ....	22 years. ....	Hypertemesis gravidarum.
Gibson, Mrs. Lillie. ....	4 years. ....	32 years. ....	Lobar pneumonia.
Hartson, Mildred. ....	7 months. ....	3 years. ....	Broncho-pneumonia.
McGraw, Mrs. D. ....	3½ years. ....	27 years. ....	Eclampsia.
Melbourne (infant). ....	2½ hours. ....	2½ hours. ....	Premature birth.
Shackleton, Mrs. Wm. ....	6 months. ....	41 years. ....	Incomplete abortion.
<i>April, 1911.</i>			
None.			
<i>May, 1911.</i>			
Holland, Daniel. ....	1 month. ....	12 years. ....	Septicæmia.
<i>June, 1911.</i>			
Collins, Harry. ....	6 days. ....	6 days. ....	Melena neonatorum.
Groves (infant). ....	10 hours. ....	10 hours. ....	Premature birth.
Kent, Mary. ....	3½ years. ....	15 years. ....	Pernicious malaria (cerebral).

*Death rate among Americans on the Isthmus.*

	Average number.	Deaths from—			Annual average per 1,000 from—		
		Disease.	Violence.	All causes.	Disease.	Violence.	All causes.
White employees from United States...	6,163	15	18	33	2.43	2.92	5.35
White women and children from United States.....	4,337	22	3	25	5.07	.60	5.76
White employees and their families from United States.....	10,500	37	21	58	3.52	2.00	5.52

*Causes and places of death of employees and civil population.*

Diseases.	Ancon Hospital.	Colon Hospital.	Panama.	Colon.	Zone.	Total.
<b>I. General diseases.</b>						
Typhoid fever.....	9	6	.....	.....	3	18
Malaria.....	1	1	135	23	67	227
Malaria (fever):						
Estivo-autumnal.....	44	17	1	1	13	76
Clinical.....	.....	.....	.....	.....	1	1
Cachexia.....	1	.....	5	.....	1	7
Hæmoglobinuric fever.....	13	2	2	.....	2	19
Measles.....	.....	3	6	1	3	13
Whooping cough.....	.....	.....	4	.....	.....	4
Diphtheria and croup.....	2	2	2	.....	.....	6
Influenza.....	.....	.....	5	.....	.....	5
Dysentery.....	2	10	19	3	16	50
Dysentery:						
Amæbic.....	4	.....	.....	1	1	6
Bacillary.....	.....	3	.....	.....	.....	3
Clinical.....	26	.....	.....	.....	1	27
Leprosy.....	1	.....	.....	.....	3	4
Erysipelas.....	.....	.....	3	.....	.....	3
Purulent infection and septicæmia.....	1	.....	.....	1	.....	2
Pyæmia.....	6	5	.....	.....	.....	11
Septicæmia.....	4	2	7	2	4	19
Pyæmia and septicæmia, pneumococcic.....	3	1	.....	.....	.....	4
Tetanus.....	.....	4	12	2	1	19
Pellagra.....	1	8	4	.....	.....	13
Beriberi.....	.....	.....	36	.....	1	37
Tuberculosis of the lungs.....	42	24	191	21	31	309
Acute miliary tuberculosis.....	5	8	1	.....	2	16
Tuberculous meningitis.....	5	.....	1	.....	.....	6
Abdominal tuberculosis.....	6	1	2	1	.....	10
Pott's disease.....	.....	1	.....	.....	.....	1
White swellings.....	.....	.....	.....	.....	1	1
Tuberculosis of the larynx.....	.....	.....	1	.....	.....	1
Tuberculosis of the skin.....	.....	.....	1	.....	.....	1
Tuberculosis of the lymph glands.....	1	.....	.....	1	.....	2
Tuberculosis of the genito-urinary organs.....	2	.....	.....	.....	.....	2
Tuberculosis of other organs.....	1	.....	1	.....	.....	2
Disseminated tuberculosis.....	57	4	.....	.....	.....	61
Rickets.....	1	.....	5	.....	.....	6
Syphilis.....	.....	.....	3	1	1	5
Secondary.....	.....	.....	.....	.....	1	1
Tertiary.....	1	1	1	.....	.....	3
Hereditary.....	.....	.....	2	.....	4	6
Cancer and other malignant tumors of the buccal cavity.....	1	.....	.....	.....	.....	1
Cancer and other malignant tumors of the stomach and liver.....	2	2	8	.....	2	14
Cancer and other malignant tumors of the female genital organs.....	.....	1	5	.....	.....	6
Cancer and other malignant tumors of the breast.....	.....	.....	.....	1	.....	1
Cancer and other malignant tumors of the skin.....	.....	.....	1	.....	.....	1
Cancer and other malignant tumors of other organs and of organs not specified.....	1	1	9	.....	1	12
Tumor of brain.....	1	.....	.....	.....	.....	1
Other tumors (tumors of the female genital organs excepted).....	1	.....	.....	.....	.....	1
Acute articular rheumatism.....	.....	.....	2	.....	.....	2
Chronic rheumatism and gout.....	.....	.....	1	.....	.....	1
Arthritis deformans.....	.....	.....	1	.....	.....	1

*Causes and places of death of employees and civil population—Continued.*

Diseases.	Ancon Hospi- tal.	Colon Hospi- tal.	Pana- ma.	Colon.	Zone.	Total.
<b>I. General diseases—Continued.</b>						
Scurvy.....			1			1
Diabetes.....	1	1				2
Leuchæmia lymphatic.....	1					1
Anæmia:						
Chlorosis.....	1		2			3
Primary, pernicious.....	1	1				2
Alcoholism (acute or chronic).....	2		6		1	9
Alcoholism, acute.....	1		11			12
Alcoholic psychosis.....	1					1
<b>II. Diseases of the nervous system and of the organs of special sense.</b>						
Encephalitis.....	1			1		2
Simple meningitis.....	5	2	15	2	2	26
Cerebro-spinal fever.....		2		1		3
Pneumococcus meningitis.....	3	6			1	10
Other diseases of the spinal cord.....		1	1			2
Cerebral hemorrhage, apoplexy.....	6	5	15	5	6	37
Softening of the brain.....	1	2				3
Paralysis without specified cause.....			5	2	1	8
Other forms of mental alienation.....	4					4
Epilepsy.....	2		2	2	2	8
Convulsions (nonpuerperal).....			2		1	3
Convulsions of infants.....			4	8	9	21
Neuralgia.....			1			1
Tumor of the brain.....	1					1
Other diseases of the nervous system.....		1		1		2
<b>III. Diseases of the circulatory system.</b>						
Pericarditis.....	2		2		1	5
Acute endocarditis.....			20		1	21
Organic disease of the heart.....	17	8	50	9	15	99
Angina pectoris.....			1	2	1	4
Aneurism.....	2	1	2	2	1	8
Arterio-sclerosis.....		1	8		2	11
Other diseases of the arteries.....			1			1
Embolism, thrombosis.....	3	2	2			7
Other diseases of the veins.....		1			1	2
Purpura hemorrhagica.....			1		1	2
Other hemorrhages; other diseases of the circulatory system.....			3	2	1	6
<b>IV. Diseases of the respiratory system.</b>						
Other diseases of nasal fossæ.....					1	1
Other diseases of the larynx.....			1			1
Acute bronchitis.....			53	12	8	73
Chronic bronchitis.....			8	1	1	10
Broncho-pneumonia.....	9	1	39	16	38	103
Pneumonia (unqualified).....	2		45	12	30	89
Lobar pneumonia.....	56	42	9	2	16	125
Pleurisy.....	1		4	3		8
Empyema.....		1			1	2
Pulmonary congestion, pulmonary apoplexy.....			21			21
Gangrene of the lungs.....	4					4
Asthma.....			1	1	1	3
Pulmonary emphysema.....					1	1
Other diseases of the respiratory system (tuberculosis excepted).....			1	1	1	3
<b>V. Diseases of the digestive system.</b>						
Stomatitis.....		2	2		3	7
Other diseases of the mouth and annæxa.....		1			1	2
Ulcer of the stomach.....	1					1
Acute gastritis.....		1	4	2	6	13
Chronic gastritis.....				1	1	2
Acute indigestion.....				1		1
Other diseases of the stomach (cancer excepted).....			6			6
Diarrhea and enteritis (under 2 years).....	7	15	271	67	57	417
Diarrhea and enteritis (2 years and over).....	1	1	39	6	6	53
Ankylostomiasis.....	1	1				2
Ascariasis.....					2	2
Other intestinal parasites.....			3		1	4
Appendicitis and typhlitis.....	2	5	3			10
Hernias, intestinal obstructions.....	1		1			2
Inguinal hernia.....			1			1
Intestinal obstruction.....	1	1	7		3	12

*Causes and places of death of employees and civil population—Continued.*

Diseases.	Ancon Hospi- tal.	Colon Hospi- tal.	Pana- ma.	Colon.	Zone.	Total.
<b>V. Diseases of the digestive system—Continued.</b>						
Diseases of the anus and fecal fistulas.....			2			2
Other diseases of the intestines.....	2		1			3
Duodenal ulcer.....	3	1				4
Acute yellow atrophy of the liver.....			1			1
Hydatid tumor of the liver.....	1					1
Cirrhosis of the liver.....	1		15	2	1	19
Abscess of liver (unqualified).....	1		3			4
Amoebic abscess of the liver.....	9	1				10
Jaundice.....	1	4	1		1	6
Other diseases of the liver.....	1		6	1	1	9
Abscess of spleen.....	1					1
Other diseases of the spleen.....		1	1			2
Simple peritonitis (nonpuerperal).....	1	4	8	6	8	27
Other diseases of the digestive system (cancer and tuberculosis excepted).....		1				1
<b>VI. Nonvenereal diseases of the genito-urinary system and annexa.</b>						
Acute nephritis.....	11	6	9	4	5	35
Bright's disease (chronic nephritis).....	42	38	60	9	24	173
Pyelonephrosis.....	5	2			1	8
Other diseases of the kidney and annexa.....	1					1
Diseases of the bladder.....			2			2
Cystitis.....			1			1
Stricture of the urethra.....	1					1
Other nonvenereal diseases of the male genital organs.....		2	1			3
Uterine hemorrhage (nonpuerperal).....			1			1
Cysts and other tumors of the ovaries.....	1					1
Salpingitis and other diseases of the female genital organs.....	1		2			3
<b>VII. The puerperal state.</b>						
Accidents of pregnancy.....		1			2	3
Hyperemesis gravidarum.....	1					1
Abortion.....	2		1			3
Puerperal hemorrhage.....	2				2	4
Puerperal septicemia.....	2		4	1	4	11
Puerperal albuminuria and convulsions.....				1		1
Eclampsia.....	3	5	1	1	1	11
Following childbirth (not otherwise defined).....					2	2
<b>VIII. Diseases of the skin and of the cellular tissue.</b>						
Gangrene.....			5			5
Furuncle.....			1			1
Acute abscess.....			2			2
<b>IX. Diseases of the bones and of the organs of locomotion.</b>						
Caries (nontuberculous).....			2			2
Mastoid abscess.....		1				1
Osteomyelitis.....	1					1
Other diseases of the bones (tuberculosis excepted).....			1			1
Other diseases of the organs of locomotion.....			1			1
<b>X. Malformations.</b>						
Congenital malformations (stillbirth not included).....					1	1
<b>XI. Diseases of early infancy.</b>						
Congenital debility, icterus, and sclerema.....	5		12	24	19	60
Premature birth.....	9	3	18	7	32	69
Other diseases peculiar to early infancy.....	6	4	9	1	8	28
Malnutrition.....	5	5	24	20	74	128
Lack of care.....	1	2	2	4	10	19
Accidents at birth.....	1	1		1	4	7
<b>XII. Old age.</b>						
Senility.....	1		11	1	6	19
<b>XIII. Affections produced by external causes.</b>						
Suicide by poisoning.....				1		1
Suicide by drowning.....					1	1
Suicide by firearms.....			4	3		7



*Causes and places of death of employees and civil population—Continued.*

Diseases.	Ancon Hospi- tal.	Colon Hospi- tal.	Pana- ma.	Colon.	Zone.	Total.
<b>XIII. Affections produced by external causes—Contd.</b>						
Suicide by cutting or piercing instruments			1			1
Poisoning by food					1	1
Other acute poisonings					1	2
Conflagration	1					1
Burns (conflagration excepted)	4	1	3	1	1	10
Absorption of deleterious gases (conflagration excepted)					1	1
Accidental drowning				4	34	38
Traumatism by firearms			3		2	5
Traumatism by cutting or piercing instruments			1			1
Traumatism by fall	4	7			5	16
Traumatism in mines and quarries	2	3			15	20
Traumatism by machines	2	3			9	12
Traumatism by other crushings (vehicles, railroads, landfalls, etc.)	25	11	1		65	102
Insolation					1	1
Lightning					1	1
Electricity (lightning excepted)			1		7	8
Homicide by firearms	2	1			1	4
Homicide by cutting or piercing instruments				1	5	6
Homicide by other means		2	1		1	4
Fractures (cause not specified)		1	1			2
Other external violence	1	1	1		4	7
<b>XIV. Ill-defined diseases.</b>						
Ill-defined organic diseases				1	1	2
Sudden death			1			1
Cause of death not specified or ill-defined	16		44	3	13	76
Infections of undetermined origin	9	6	1			16
Total	571	330	1,422	319	767	3,409
Stillbirths	1	14	153	42	118	328
Grand total	572	344	1,575	361	885	3,737

NOTE.—The deaths occurring in Ancon and Colon Hospitals resulting from illness, injury, or other cases admitted from the cities of Panama and Colon, or from the Canal Zone, are in the table of vital statistics, credited to the places from whence they were admitted.

*Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission from all causes, for the fiscal year 1910-11.*

Diseases.	Dis- charged.	Died.
<b>I. General diseases.</b>		
Typhoid fever	79	9
Relapsing fever	2	
Malaria	249	
Malaria fever:		
Estivo autumnal	5,385	34
Tertian	938	
Quartan	47	
Mixed	39	
Undetermined	176	
Clinical	2,962	
Cachexia	28	
Hemoglobinuric fever	7	8
Vaccinia	6	
Measles	137	1
Diphtheria and croup	3	
Influenza	307	
Dysentery:		
Amebic	42	
Bacillary	6	2
Clinical	69	11
Leprosy	2	
Erysipelas	4	
Chicken pox	4	
German measles	4	
Mumps	96	
Yaws	4	
Other epidemic diseases	9	

Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission from all causes, for the fiscal year 1910-11—Continued.

Diseases.	Discharged.	Died.
<i>I. General diseases—Continued.</i>		
Purulent infection and septicæmia.....		2
Pyæmia.....	1	7
Septicæmia.....		3
Pyæmia and septicæmia, pneumococci.....		4
Tetanus.....		2
Pellagra.....	2	
Tuberculosis of the lungs.....	109	27
Acute miliary tuberculosis.....		3
Tuberculous meningitis.....		3
Abdominal tuberculosis.....	4	4
Pott's disease.....	7	
White swellings.....	1	
Tuberculosis of bones and joints.....	15	
Tuberculosis of the lymph glands.....	12	
Tuberculosis of the genitourinary organs.....	3	1
Tuberculous abscess.....	4	
Tuberculosis of other organs.....	5	
Disseminated tuberculosis.....	1	27
Syphilis.....	2	
(a) Primary.....	12	
(b) Secondary.....	119	
(c) Tertiary.....	94	1
(d) Hereditary.....	2	
(e) Period not stated.....	19	
Soft chancre.....	180	
Adenitis chancroidal.....	434	
Gonococcus infection.....	220	
Gonorrhea.....	232	
Gonorrheal arthritis.....	40	
Gonorrheal ophthalmia.....	11	
Cancer and other malignant tumors of the buccal cavity.....	2	
Cancer and other malignant tumors of the stomach and liver.....	5	3
Cancer and other malignant tumors of the peritonæum, intestines, rectum.....	1	
Cancer and other malignant tumors of the skin.....	3	
Cancer and other malignant tumors of other organs and of organs not specified.....	7	2
Other tumors (tumors of the female genital organs excepted).....	36	1
Acute articular rheumatism.....	29	
Chronic rheumatism and gout.....	13	
Gout.....	1	
Arthritis deformans.....	2	
Muscular rheumatism.....	35	
Diabetes.....	8	1
Exophthalmic goitre.....	1	
Leucæmia lymphatic.....		1
Anæmia, chlorosis.....	64	1
Chlorosis.....	1	
Anæmia, primary, pernicious.....	2	
Other general diseases.....	1	
Alcoholism (acute or chronic).....	36	
Alcoholism, acute.....	64	2
Alcoholic psychosis.....	15	
Morphinism.....	1	
Other chronic poisonings.....	1	
<i>II. Diseases of the nervous system and of the organs of special sense.</i>		
Simple meningitis.....		5
Pneumococcus meningitis.....		1
Other diseases of the spinal cord.....	2	
Cerebral hæmorrhage, apoplexy.....	3	7
Softening of the brain.....	1	
Paralysis without specified cause.....	9	
Other forms of mental alienation.....	15	1
Epilepsy.....	21	2
Hysteria.....	9	
Neuralgia.....	36	
Neuritis.....	86	
Tumor of the brain.....		1
Neurasthenia.....	134	
Other diseases of the nervous system.....	50	1
Follicular conjunctivitis.....	9	
Trachoma.....	2	
Other diseases of the eye and its adnexa.....	657	
Diseases of the ear.....	183	
<i>III. Diseases of the circulatory system.</i>		
Pericarditis.....	1	
Acute endocarditis.....	3	1

*Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission from all causes, for the fiscal year 1910-11—Continued.*

Diseases.	Discharged.	Died.
<b>III. Diseases of the circulatory system—Continued.</b>		
Organic disease of the heart.....	33	10
Angina pectoris.....	1	
Aneurism.....	2	1
Arteriosclerosis.....	17	
Other diseases of the arteries.....	2	
Hæmorrhoids.....	123	
Varices.....	16	
Varicocele.....	33	
Phlebitis.....	5	
Other diseases of the veins.....	4	
Lymph adenitis (nonvenereal).....	121	
Other diseases of the lymphatic system.....	30	
Pupura hæmorrhagica.....	1	
<b>IV. Diseases of the respiratory system.</b>		
Adenoid vegetations.....	7	
Inflammation of accessory nasal sinuses.....	52	
Myiasis of nasal fosse and sinuses.....	8	
Other diseases of nasal fosse.....	185	
Laryngitis.....	6	
Other diseases of the larynx.....	1	
Diseases of the thyroid body.....	4	
Acute bronchitis.....	363	
Chronic bronchitis.....	65	
Broncho-pneumonia.....	23	3
Pneumonia (unqualified).....	4	1
Lobar pneumonia.....	210	75
Pleurisy.....	100	1
Empyema.....	4	
Pulmonary congestion, pulmonary apoplexy.....	5	
Gangrene of the lungs.....		2
Asthma.....	30	
Pulmonary emphysema.....	18	
Abscess of lungs.....	2	1
Other diseases of the respiratory system (tuberculosis excepted).....	10	
<b>V. Diseases of the digestive system.</b>		
Diseases of the teeth and gums.....	17	
Stomatitis.....	5	
Other diseases of the mouth and adnexa.....	49	
Pharyngitis.....	63	
Follicular tonsillitis.....	126	
Other diseases of the pharynx.....	63	
Ulcer of the stomach.....	7	
Acute gastritis.....	36	
Chronic gastritis.....	23	
Acute indigestion.....	167	
Other diseases of the stomach (cancer excepted).....	7	
Diarrhea and enteritis (two years and over).....	153	4
Ankylostomiasis.....	47	
Ascariasis.....	1	
Tapeworm.....	5	
Strongyloides.....	3	
Other intestinal parasites.....	5	
Appendicitis and typhlitis.....	180	3
Hernias, intestinal obstructions.....	16	1
Inguinal hernia.....	242	
Other hernias.....	14	
Intestinal obstruction.....		1
Diseases of the anus and fecal fistulas.....	42	
Other diseases of the intestines.....	130	
Duodenal ulcer.....	16	
Bilharziosis.....	2	2
Hydatid tumor of the liver.....		1
Cirrhosis of the liver.....	28	
Biliary calculi.....	3	
Abscess of liver (unqualified).....	8	
Amoebic abscess of the liver.....	4	8
Cholecystitis.....	9	
Jaundice.....	33	
Other diseases of the liver.....	12	
Other diseases of the spleen.....	2	1
Simple peritonitis (nonpuerperal).....	10	2
Other diseases of the digestive system (cancer and tuberculosis excepted).....	3	
<b>VI. Nonvenereal diseases of the genito-urinary system and adnexa.</b>		
Acute nephritis.....	23	5
Bright's disease (chronic nephritis).....	167	30

*Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission from all causes for the fiscal year 1910-11—Continued.*

Diseases.	Discharged.	Died.
<b>VI. Nonvenereal diseases of the genito-urinary system and adnexa—Continued.</b>		
Movable kidney.....	1	
Pyelo-nephrosis.....	2	1
Other diseases of the kidney and adnexa.....	9	1
Calculi of the urinary passages.....	20	
Diseases of the bladder.....	9	
Cystitis.....	24	
Stricture of the urethra.....	70	1
Other diseases of the urethra, urinary abscess, etc.....	18	
Acute prostatitis.....	2	
Chronic prostatitis.....	3	
Other diseases of the prostate.....	1	
Hydrocoele.....	79	
Lymph scrotum and varix.....	1	
Other nonvenereal diseases of the male genital organs.....	127	
Other diseases of the uterus.....	3	
Cysts and other tumors of the ovaries.....	2	
Salpingitis and other diseases of the female genital organs.....	2	
Nonpuerperal diseases of the breast (cancer excepted).....	1	
Benign tumor of breast.....	1	
<b>VII. The puerperal state.</b>		
Abortion.....	1	
<b>VIII. Diseases of the skin and of the cellular tissue.</b>		
Gangrene.....	1	
Furuncle.....	72	
Carbuncle.....	22	
Acute abscess.....	148	
Phlegmon.....	6	
Trichophytosis.....	1	
Scabies.....	5	
Other diseases of the skin and adnexa.....	417	
Pemphigus contagiosus.....	1	
Mycetoma.....	1	
Filaria medinensis.....	3	
Elephantiasis.....	6	
Myiasis of skin.....	1	
Dhobie itch.....	25	
Ulcer of the skin.....	164	
Tropical ulcer.....	4	
Impetigo contagiosa.....	4	
Urticaria.....	1	
<b>IX. Diseases of the bones and of the organs of locomotion.</b>		
Caries (nontuberculous).....	10	
Mastoid abscess.....	4	
Osteomyelitis.....	5	
Periostitis.....	23	
Other diseases of the bones (tuberculosis excepted).....	27	
Ankylosis.....	4	
Arthritis.....	89	
Synovitis.....	44	
Other diseases of the joints (tuberculosis and rheumatism excepted).....	34	
Amputations.....	91	
Other diseases of the organs of locomotion.....	125	
<b>X. Malformations.</b>		
Congenital malformations (stillbirth not included).....	8	
<b>XIII. Affections produced by external causes.</b>		
Poisoning by food.....	50	
Venomous bites and stings.....	2	
Snake bites.....	1	
Other acute poisonings.....	2	
Burns (conflagration excepted).....	124	1
Absorption of deleterious gases (conflagration excepted).....	1	
Traumatism by firearms.....	13	
Traumatism by cutting or piercing instruments.....	297	
Traumatism by fall.....	80	4
Traumatism in mines and quarries.....	1,787	6
Traumatism by machines.....	186	1
Traumatism by other crushings (vehicles, railroads, landslides, etc.).....	233	36
Injuries by animals.....	1	
Electricity (lightning excepted).....	4	
Homicide by firearms.....		2

Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission from all causes for the fiscal year 1910-11—Continued.

Diseases.	Discharged.	Died.
<b>XIII. Affections produced by external causes—Continued.</b>		
Homicide by cutting or piercing instruments.....		1
Homicide by other means.....		1
Dislocations.....	34	
Sprains.....	250	
Fractures (cause not specified).....	456	1
Other external violence.....	4	
<b>XIV. Ill-defined diseases.</b>		
Ill-defined organic diseases.....	15	
Cause of death or disease not specified or ill-defined.....	107	3
No disease, feigned disease.....	61	
Infections of undetermined origin.....	49	7
Total.....	22, 435	397

Consolidated hospital report.

Hospitals.	Remain- ing July 1.		Admitted.		Died.		Discharged.		Trans- ferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
<b>Ancon Hospital:</b>												
Employees.....	371	455	8, 955	8, 845	52	203	6, 260	8, 428	2, 655	56	350	613
Nonemployees.....	59	88	2, 112	1, 649	46	235	1, 974	1, 373	50	47	92	82
Insane.....	30	271	36	266	4	31	17	133	11	68	34	306
Total.....	460	814	11, 103	10, 760	102	469	8, 251	9, 934	2, 725	171	485	1, 000
<b>Colon Hospital:</b>												
Employees.....	163	155	3, 130	2, 336	31	98	2, 618	2, 092	515	172	129	129
Nonemployees.....	30	57	928	1, 209	17	184	887	962	14	43	40	77
Total.....	193	212	4, 058	3, 545	48	282	3, 505	3, 054	529	215	169	206
<b>Culebra Hospital:</b>												
Employees.....			3	1	2		1	1				
Nonemployees.....	5	9	92	274		1	94	256	2	18	1	8
Total.....	5	9	95	275	2	1	95	257	2	18	1	8
<b>Palo Seco Leper Asylum:</b>												
Employees.....		1	1	3			1	4				
Nonemployees.....	1	34		20		4		5		2	1	43
Total.....	1	35	1	23		4	1	9		2	1	43
<b>Taboga Sanitarium:</b>												
Employees.....	66		3, 099				3, 019		52		94	
Nonemployees.....	21		731				740		1		2	
Total.....	87		3, 830				3, 758		53		96	
<b>Grand total:</b>												
Employees.....	600	611	15, 188	11, 185	85	301	11, 890	10, 525	3, 222	228	582	742
Nonemployees.....	116	188	3, 863	3, 152	63	424	3, 704	2, 696	76	110	136	210
Insane.....	80	271	36	266	4	31	17	133	11	68	34	306
Total.....	746	1, 070	19, 087	14, 603	152	756	15, 620	13, 254	3, 309	406	752	1, 267

*Consolidated sick-camp report.*

Stations.	Re- main- ing July 1.		Admitted.		Died.		Dis- charged.		Trans- ferred.		Remain- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Ancon.....	4	1	5	180	.....	.....	9	171	.....	10	.....	.....
Corozal.....	.....	.....	56	80	.....	.....	41	51	15	29	.....	.....
Miraflores.....	5	2	835	574	.....	.....	587	451	245	122	6	3
Pedro Miguel.....	7	6	511	577	.....	.....	363	409	144	168	11	6
Paraiso.....	4	4	175	395	.....	1	147	304	28	88	4	6
Culebra.....	2	1	552	761	1	1	352	428	194	320	7	13
Empire.....	3	6	415	888	.....	2	339	660	76	223	3	9
Las Cascadas.....	5	4	586	545	.....	3	462	455	119	86	10	5
Bas Obispo.....	3	3	294	613	.....	3	246	511	49	97	2	10
Gorgona.....	1	3	185	724	.....	1	149	556	37	163	.....	7
San Pablo.....	7	8	356	304	.....	.....	292	271	71	41	.....	.....
Tabernilla.....	6	10	493	724	.....	.....	375	598	124	136	.....	.....
Frijoles.....	.....	.....	.....	85	.....	.....	.....	74	.....	11	.....	.....
Bohio.....	.....	.....	1	24	.....	.....	1	22	.....	2	.....	.....
Gatun.....	13	25	2,129	3,060	.....	1	1,410	2,265	726	1,418	6	31
Cristobal.....	3	7	390	987	.....	.....	249	598	141	387	3	9
Porto Bello.....	4	5	325	493	.....	2	261	394	64	101	4	1
Nombre de Dios.....	1	.....	22	171	.....	.....	21	164	2	5	.....	2
Toro Point.....	.....	.....	226	433	.....	.....	207	394	14	32	5	7
Total.....	66	90	7,556	12,248	1	14	5,511	8,776	2,049	3,439	61	109

*Consolidated report of employees sick in quarters.*

Stations.	Days excused for quarters.		New patients ex- cused for quarters.	
	White.	Colored.	White.	Colored.
Ancon.....	707	27	294	11
Balboa.....	382	28	259	20
Corozal.....	416	.....	239	.....
Miraflores.....	126	110	90	86
Pedro Miguel.....	1,016	160	456	48
Paraiso.....	687	23	238	7
Culebra.....	1,035	223	479	86
Empire.....	1,696	8	953	6
Las Cascadas.....	893	5	328	2
Bas Obispo.....	393	.....	118	.....
Gorgona.....	3,777	18	1,814	1
San Pablo.....	185	3	83	3
Tabernilla.....	336	2	124	2
Frijoles.....	6	15	4	7
Bohio.....	9	11	5	4
Gatun.....	1,917	1	950	1
Cristobal.....	2,694	2,224	1,269	493
Porto Bello.....	373	.....	222	.....
Nombre de Dios.....	116	118	61	48
Toro Point.....	384	242	243	189
Total.....	17,148	3,218	8,229	1,014

*Consolidated hospital, sick-camp, and sick-in-quarters report.*

	Remaining July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Hospitals.....	746	1,070	19,087	14,603	152	756	15,620	13,254	3,309	406	752	1,257
Sick camps.....	66	90	7,556	12,248	1	14	5,511	8,776	2,049	3,439	61	109
<b>Total.....</b>	<b>812</b>	<b>1,160</b>	<b>26,643</b>	<b>26,851</b>	<b>153</b>	<b>770</b>	<b>21,131</b>	<b>22,030</b>	<b>5,358</b>	<b>3,845</b>	<b>813</b>	<b>1,366</b>

	White.	Colored.	Total.
Total admissions to hospitals and sick camps.....	26,643	26,851	53,494
Number of employees sick in quarters.....	8,229	1,014	9,243
<b>Total.....</b>	<b>34,872</b>	<b>27,865</b>	<b>62,737</b>
Less number of patients transferred from sick camps to hospitals, and from hospitals to sanitarium, whose admissions are duplicated in above figures.	5,358	3,845	9,203
<b>Net admissions to hospitals and sick camps, and those sick in quarters.</b>	<b>29,514</b>	<b>24,020</b>	<b>53,534</b>

*Consolidated dispensary report.*

Stations.	Employees.		Nonemployees.		Total.	
	White.	Colored.	White.	Colored.	White.	Colored.
Ancon.....	4,777	12,365	2,755	2,285	7,532	14,650
Balboa.....	12,168	15,189	3,667	1,544	15,835	16,733
Corozal.....	8,944	6,287	3,068	611	12,012	6,896
Miraflores.....	12,610	13,042	249	596	12,859	13,638
Pedro Miguel.....	16,645	15,007	2,723	1,975	19,368	16,982
Paraiso.....	5,028	4,236	2,715	1,288	7,543	5,524
Culebra.....	22,660	19,967	9,094	7,909	31,784	27,876
Empire.....	18,166	23,496	11,322	7,842	29,487	31,338
Las Cascadas.....	15,689	11,053	8,386	4,854	24,075	15,907
Bas Obispo.....	15,205	15,163	3,249	2,065	18,454	17,228
Gorgona.....	22,993	20,874	5,872	4,457	28,865	25,331
San Pablo.....	7,494	7,383	1,368	2,532	8,862	9,915
Tabernilla.....	6,740	6,263	2,175	1,962	8,915	8,245
Frijoles.....	699	2,243	27	294	726	2,537
Bohio.....	203	2,147	145	2,613	348	4,760
Gatun.....	41,593	49,283	4,052	2,814	45,645	52,097
Cristobal.....	17,947	22,377	6,945	5,123	24,892	27,500
Porto Bello.....	7,182	9,966	414	544	7,596	10,510
Nombre de Dios.....	1,156	2,298	39	1,282	1,195	3,580
Toro Point.....	7,479	8,676	258	204	7,737	8,880
<b>Total.....</b>	<b>245,407</b>	<b>267,315</b>	<b>68,523</b>	<b>52,814</b>	<b>313,930</b>	<b>320,129</b>

*Average number of employees constantly sick in hospitals, sick camps, and quarters.*

Hospitals.	White.	Colored.	Total.
Ancon Hospital.....	324.45	383.45	707.90
Colon Hospital.....	114.82	118.53	233.35
Culebra Hospital.....	.07	.06	.12
Palo Seco Leper Asylum.....	.17	.50	.67
Taboga Sanitarium.....	61.06	.....	61.06
<b>Total.....</b>	<b>500.57</b>	<b>502.53</b>	<b>1,003.10</b>

*Average number of employees constantly sick in hospitals, sick camps, and quarters—Con.*

	Sick camps.			Sick in quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Ancon.....	.07	1.24	1.31	1.94	.07	2.01
Balboa.....				1.05	.08	1.13
Corozal.....	.23	.38	.61	1.14		1.14
Miraflores.....	5.44	3.36	8.80	.34	.34	.64
Pedro Miguel.....	5.30	5.95	11.25	2.78	.44	3.22
Paraiso.....	1.58	3.47	5.05	1.88	.06	1.94
Culebra.....	4.65	5.84	10.49	2.84	.61	3.45
Empire.....	3.54	6.00	10.14	4.65	.02	4.67
Las Cascadas.....	5.10	4.58	9.68	2.44	.01	2.45
Bas Obispo.....	2.94	6.52	9.46	1.08		1.08
Gorgona.....	1.43	6.27	7.70	10.35	.05	10.40
San Pablo.....	4.40	3.89	8.29	.51	.01	.52
Tabernilla.....	4.83	7.02	11.85	.92	.01	.93
Frijoles.....		.39	.39	.02	.04	.06
Bohio.....		.13	.13	.03	.03	.06
Gatun.....	13.08	21.05	34.13	5.25		5.25
Cristobal.....	3.62	8.15	11.77	7.38	6.09	13.47
Porto Bello.....	3.58	4.63	8.21	1.02		1.02
Nombre de Dios.....	.18	1.33	1.51	.32	.32	.64
Toro Point.....	2.50	4.68	7.18	1.05	.66	1.71
Total.....	62.47	95.48	157.95	46.99	8.80	55.79

*Average number of employees constantly sick.*

	White.	Colored.	Total.
Hospitals.....	500.57	502.53	1,003.10
Sick camps.....	62.47	95.48	157.95
Sick in quarters.....	46.99	8.80	55.79
Total.....	610.03	606.81	1,216.84

*Average number of employees constantly sick per 1,000.*

	White.	Colored.	Total.
Hospitals.....	38.83	13.87	20.42
Sick camps.....	4.85	2.63	3.21
Sick in quarters.....	3.64	.24	1.14
Total.....	47.32	16.74	24.77

*Average number of days' treatment per employee in hospitals, sick camps, and quarters.*

Hospitals.	White.	Colored.	Total.
Ancon Hospital.....	13.21	16.11	14.64
Colon Hospital.....	13.25	14.08	15.41
Culebra Hospital.....	8.33	19.00	11.00
Palo Seco Leper Asylum.....	62.00	45.75	49.00
Taboga Sanitarium.....	7.26		7.26
Total.....	12.02	16.59	13.94



*Average number of days' treatment per employee in hospitals, sick camps, and quarters—*  
Continued.

	Sick camps.			Quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Ancon.....	2.89	2.50	2.52	2.40	2.45	2.41
Balboa.....				1.47	1.40	1.47
Corozal.....	1.48	1.74	1.63	1.74		1.74
Miraflores.....	2.38	2.14	2.28	1.40	1.28	1.34
Pedro Miguel.....	3.82	3.77	3.79	2.23	3.33	2.33
Paraíso.....	3.30	3.22	3.25	2.89	3.29	2.89
Culebra.....	3.10	2.84	2.95	2.16	2.59	2.23
Empire.....	3.12	2.72	2.85	1.78	1.33	1.78
Las Cascadas.....	3.20	3.08	3.14	2.72	2.50	2.72
Bas Obispo.....	3.64	3.90	3.81	3.33		3.33
Gorgona.....	2.80	3.16	3.00	2.08	18.00	2.09
San Pablo.....	4.42	4.55	4.48	2.23	1.00	2.19
Tabernilla.....	3.54	3.49	3.51	2.71	1.00	2.68
Frijoles.....		1.67	1.67	1.50	2.14	1.91
Bohío.....	1.00	1.96	1.92	1.80	2.75	2.22
Gatun.....	2.25	2.09	2.14	2.02	1.00	2.02
Cristobal.....	3.39	3.02	3.13	2.12	4.51	2.79
Porto Bello.....	4.02	3.40	3.65	1.68		1.68
Nombre de Dios.....	2.83	2.87	2.81	1.90	2.46	2.15
Toro Point.....	4.13	4.01	4.05	1.58	1.28	1.45
Total.....	3.02	2.85	2.91	2.08	3.17	2.20

*Subsistence and operating expenses.*

SUBSISTENCE EXPENSES.

	Hospitals.	Sick camps.	Total.
Number of days' rations issued to patients.....	579,756	57,648	637,404
Cost of rations issued to patients.....	\$146,283.19	\$13,274.60	\$159,557.79
Cost of subsistence per patient per day.....	\$0.254	\$0.230	\$0.250

OPERATING EXPENSES.

Number of days' relief furnished patients.....	579,756	57,648	637,404
Cost of operation.....	\$717,421.82	\$24,527.57	\$741,949.49
Cost per capita per day.....	\$1.24	\$0.43	\$1.16
Cost of operation with amount received from outside patients, etc., deducted.....	\$587,627.13	\$24,527.57	\$612,154.70
Cost per capita per day with above deduction.....	\$1.01	\$0.43	\$0.96
Cost of dispensaries.....	\$171,133.65		

*Outside patients treated in hospitals, and amounts collected for their treatment.*

	Number of cases treated.	Number of days' relief.	Amount.
Patients for whom the Republic of Panama pays 75 cents per day.	2,606	72,982	\$54,772.25
Patients for whom the Canal Zone government pays 30 cents per day.....	379	9,067	2,709.00
Patients paying 30 cents per day for themselves.....	2,354	23,086	6,916.80
Patients from the Republic of Panama paying other prices.....	1,376	12,166	23,209.70
Patients from the Canal Zone paying other prices.....	3,062	23,268	31,861.75
Patients from the Canal Zone not paying.....	2,966	59,785	
Patients from the Republic of Panama not paying.....	941	15,317	
Total.....	13,714	215,731	119,490.50

NOTE.—Patients carried from one month to another are considered as separate cases in above table.

*Surgical operations performed in hospitals.*

	Number.	Died.
<b>Amputations:</b>		
Shoulder.....	2	
Arm.....	3	1
Forearm.....	4	
Hand.....	3	
Hip joint.....	1	
Thigh.....	15	
Leg.....	32	1
Foot.....	7	
Digits, multiple.....	66	
Thigh, double.....	4	2
Leg, double.....	4	
Arm and leg.....	1	1
<b>Operations on bones:</b>		
Cranioectomy, decompressive.....	23	7
Laminectomy.....	4	3
Ostelectomy.....	35	1
Excision of maxilla.....	1	
Resection of wrist.....	4	
Resection of hip.....	2	
Wiring of fractures, simple.....	42	
Wiring of fractures, compound.....	21	
<b>Adenectomy:</b>		
Cervical.....	20	2
Axillary.....	16	
Inguinal—		
Single.....	356	
Double.....	78	
Femoral.....	23	
<b>Herniotomy:</b>		
Inguinal—		
Single.....	193	
Double.....	107	
Femoral.....	1	
Ventral.....	21	
Combined (any two of the above).....	3	
Strangulated.....	9	1
<b>Genito-urinary tract:</b>		
Nephrotomy.....	2	
Nephrectomy.....	1	
Nephropexy.....	1	
Perinephritic abscess, drainage of.....	1	
Ureterotomy.....	2	
Cystotomy.....	1	
Urethrotomy—		
Internal.....	41	
External.....	61	2
Prostatectomy.....	6	2
Varicocele, radical cure.....	44	
Hydrocele—		
Single, radical cure.....	87	
Double, radical cure.....	26	
Orchidectomy.....	25	
Epididymotomy.....	48	
Vasectomy.....	2	
Amputation of scrotum.....	2	
Amputation of penis.....	3	
Curetage uteri.....	162	
Perineoplasty.....	23	
Trachelorrhaphy.....	23	
Vaginal sections.....	43	1
Vaginal punctures.....	3	
<b>Obstetrical:</b>		
Cæsarian section, abdominal.....	3	2
Accouchement force.....	7	1
High forceps.....	9	
Low forceps.....	14	
Version.....	14	1
Perineorrhaphy.....	104	
<b>Thorax:</b>		
Thoracotomy.....	12	1
Thoracoplasty.....	1	
Pneumothoracotomy.....	1	1
Excision of breast.....	1	
Excision of breast and axilla.....	4	
Gunshot wound of chest, operation for.....	3	
Stab wound of chest, operation for.....	2	
<b>Rectum:</b>		
Hemorrhoids, radical cure.....	137	
Fistula in anus, excision of.....	39	1
<b>General:</b>		
Thyroidectomy.....	6	
Nerve stretching.....	2	

*Surgical operations performed in hospitals—Continued.*

	Number.	Died.
<b>General—Continued.</b>		
Aneurismorrhaphy.....	1	.....
Varicose veins, excision of.....	16	.....
Tenorrhaphy.....	12	.....
Myorrhaphy.....	3	.....
Excision of surface neoplasms.....	18	.....
Gunshot wound of soft parts, operation for.....	6	.....
Stab wound of soft parts, operation for.....	1	.....
Extensive injuries to soft parts, operation for.....	12	.....
Plastic operation for congenital defect.....	10	1
Plastic operation for severe injuries.....	15	.....
Plastic operation for effects of disease.....	43	.....
Skin graft.....	67	.....
<b>Laparotomy:</b>		
For general peritonitis.....	19	5
For tuberculous peritonitis.....	7	2
For intestinal obstruction.....	6	1
Exploratory.....	33	2
Gastrotomy.....	2	1
Gastro-enterostomy.....	8	.....
Enter-enterostomy.....	1	.....
Enterectomy.....	2	1
Enterorrhaphy.....	3	2
Appendectomy.....	183	.....
Appendectomy with local peritonitis.....	26	1
Appendectomy with general peritonitis.....	20	6
Appendicostomy.....	1	.....
Cecostomy.....	7	1
Colostomy.....	1	1
Sigmoidoexy.....	4	.....
Cholecystostomy.....	3	.....
Cholecystostomy.....	8	.....
Cholecystectomy.....	1	.....
Abscess of liver—		
Laparo-hepatotomy for.....	13	5
Thoraco-hepatotomy for.....	10	4
Pan-hysterectomy.....	7	.....
Supravaginal hysterectomy.....	24	.....
Hysteromyectomy.....	26	.....
Myomectomy.....	9	.....
Salpingectomy—		
Single.....	24	.....
Double.....	15	.....
Salpingo-oophorectomy.....	12	.....
Ovarian cystectomy.....	15	.....
Oophorectomy.....	1	.....
Suspensio-uteri.....	40	.....
Plastic operation for chronic pelvic peritonitis.....	40	.....
For ectopic gestation.....	9	.....
<b>For trauma:</b>		
General peritonitis.....	1	1
Hemoperitoneum.....	3	1
Rupture of liver.....	3	2
Rupture of spleen.....	2	.....
Gunshot wound of abdomen.....	3	1
Major operations, various other.....	20	1
Minor operations, various.....	4,387	2
<b>Total.....</b>	<b>7,299</b>	<b>72</b>

*Operations and work performed in eye, ear, nose, and throat clinics.*

<b>Operations:</b>		<b>Operations—Continued.</b>	
Abscess—		Drainage of maxillary sinus.....	12
Alveolar.....	1	Enucleation.....	6
Lingual, drainage.....	1	Ethmoidotomy.....	2
Adenectomy.....	61	Evisceration.....	9
Adenectomy and tonsillectomy.....	51	Excision of chalazion.....	6
Adenectomy and tonsillotomy.....	6	Excision, cyst, cervical.....	2
Advancement of external rectus.....	8	Excision, dermoid cyst, upper lid.....	1
Advancement of internal rectus.....	1	Excision of hard palate.....	1
Amputation of uvula.....	2	Excision, Keloid.....	1
Blepharoplasty (with Fricke flap).....	1	Excision of Xanthoma of lids.....	1
Cataract, dissection of.....	16	Expression for follicular conjunctivitis.....	34
Cataract, needling.....	2	Expression for trachoma.....	4
Cellulitis, lower jaw, incision and curet-		External canthoplasty.....	1
age.....	1	Extraction of cataract.....	16
Conjunctivitis, follicular, grattage.....	2	Holrath-Kuhnt operation for trachoma.....	1
Curetage of middle ear.....	1	Incision and drainage of abscess, Calvar-	
Dacryocystotomy.....	6	ian.....	1
Drainage of frontal sinus.....	5	Incision and drainage of cellulitis, eye lid.....	2

*Operations and work performed in eye, ear, nose, and throat clinics—Continued.*

## Operations—Continued.

Incision and drainage of lacrimal sac.....	2
Incision of alveolar abscess.....	3
Incision of chalazion.....	1
Incision of dacryocyst.....	2
Incision of furuncle, ear.....	3
Incision of larynx.....	1
Incision of peritonsillar abscess.....	3
Incision of thyroid abscess.....	1
Intubation.....	1
Iridectomy.....	27
Keratotomy.....	1
Killian's operation—frontal sinus.....	3
Lacrimal canaliculus incised.....	4
Lacrimal duct probed.....	31
Laryngeal sinus, closure.....	1
Laryngo-fissure.....	1
Mastoidotomy, simple.....	7
Mastoidotomy, radical.....	4
Mastoidectomy.....	1
Ossiculectomy.....	4
Paracentesis of cornea.....	11
Paracentesis of membrana tympani.....	27
Paraffina prosthesis of nose.....	1
Plastic on ear.....	6
Plastic on eyelid.....	12
Plastic, face.....	2
Plastic on lip.....	1
Plastic on nose.....	8

## Operations—Continued.

Plastic, pharynx.....	1
Pterygium, ablation.....	15
Pterygium, transplantation.....	52
Removal of bullet from nose.....	1
Removal of cyst, ear.....	2
Removal of foreign body from ear.....	2
Removal of foreign body from nose.....	1
Removal of nasal polyp.....	17
Removal of nasal spur.....	1
Removal of screw-worm from nose.....	1
Septal spurs.....	2
Sinusotomy, maxillary exploratory.....	1
Submucous resection of nasal septum.....	171
Suture, lacerated sclera.....	1
Symblepharon, plastic.....	1
Tarsalectomy for trachoma.....	1
Tenotomy.....	5
Tonsillectomy.....	138
Tonsillotomy.....	29
Turbinectomy.....	27
Various other minor operations.....	1,168
Total.....	2,071
Refractions.....	2,589
Outside cases treated.....	16,985
Grand total.....	21,645

*Consolidated ward laboratory report of all hospitals.*

Blood examinations.....	23,294
Etiyo-autumnal.....	7,591
Tertian, single.....	1,429
Tertian, double.....	3
Mixed tertian and etiyo-autumnal.....	33
Quartan.....	83
Lepra bacilli.....	2
Differential blood counts.....	1,146
Leucocyte counts.....	3,049
Red blood counts.....	413
Red and white blood counts.....	35
Hemoglobin estimations.....	714
Filaria.....	65
Spirillum Novyi.....	2
Crescents.....	3
Gualac and turpentine tests for invisible blood.....	673
Stool examinations.....	11,743
Ascaris lumbricoides.....	594
Uncinaria ova.....	1,650
Uncinaria worms.....	4
Tricocephalus dispar.....	1,125
Strongyloides intestinalis.....	477
Tenia.....	8
Tenia saginata.....	6
Amoeba.....	232
Amoeba coli.....	29
Ciliated monads.....	350
Bilharzia.....	9
Pus and blood.....	970
Pus and epithelial cells.....	80
Balanitidium coli.....	12
Tubercle bacilli.....	47
Oxyuris vermicularis.....	2
Entamoeba, histolytica.....	13

## Stool examinations—Continued.

Thymol treatments.....	26
Entamoeba coli.....	1
Trichuris trichinura.....	3
Urine examinations.....	33,887
Albumen.....	9,158
Albumen and casts.....	6,901
Sugar.....	180
Pus and blood.....	871
Gonococci.....	7
Indican.....	16
Epithelium.....	250
Hemoglobin.....	3
Bile.....	8
Dialo reactions.....	83
Microscopical examinations.....	1,071
Urea estimations.....	114
Dyslococci.....	2
Tubercle bacilli.....	33
Hemin crystals.....	81
Gualac test.....	138
Glucose.....	3
Red blood cells.....	34
White blood cells.....	4
Pus and epithelium.....	65
Sputum examinations.....	2,470
Tubercle bacilli.....	272
Pneumococci.....	3
Miscellaneous:	
Examinations of spinal fluid.....	24
Examination of pus, blood, and tissue.....	252
Examinations of various smears and discharges.....	250
Gastric analyses.....	57

## ANCON HOSPITAL.

Classes.	Re- main- ing July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Isthmian Canal Commission employees.....	362	372	8,523	7,192	50	154	5,937	6,862	2,558	46	340	502
Panama Railroad employees.....	9	83	432	1,653	2	49	323	1,566	97	10	19	111
Pay patients.....	48	63	1,799	1,026	35	87	1,673	938	53	18	86	46
Charity patients.....	11	25	313	623	11	148	301	435	6	29	6	36
Insane patients.....	30	271	36	266	4	31	17	133	11	68	34	305
Total.....	460	814	11,103	10,760	102	469	8,251	9,934	2,725	171	485	1,000

	White.	Colored.	Total.
Average number of days' treatment per employee for the year.....	13.21	16.11	14.64
Average number of employees constantly sick during the year.....	324.45	383.45	707.90
Number of days' relief furnished patients.....			411,874
Cost of subsistence per patient per day.....			\$0.218

## Nationality.

Classes.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Isthmian Canal Commission employees.....	16,449	3,385	17	5,408	7,639
Panama Railroad employees.....	2,177	208		194	1,775
Pay patients.....	2,936	1,180	1	634	1,121
Charity patients.....	972	193	1	138	640
Insane patients.....	603	8		55	540
Total.....	23,137	4,974	19	6,429	11,715

For operations, see report of all surgical operations.

For laboratory report, see consolidated ward laboratory report

## COLON HOSPITAL.

Classes.	Remaining July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Isthmian Canal Commission employees.....	150	116	2,616	1,581	26	60	2,216	1,440	416	112	108	76
Panama Railroad employees.....	13	39	514	755	5	38	402	643	99	60	21	53
Private pay.....	19	19	706	624	11	74	680	529	10	7	24	33
Municipal pay.....		3	17	67		19	16	44		1	1	6
Zone charity.....	11	35	205	518	6	91	191	389	4	35	15	38
Total.....	193	212	4,058	3,545	48	282	3,505	3,064	529	215	169	206

	White.	Colored.	Total.
Average number of days' treatment per employee for the year.....	13.25	14.08	15.41
Average number of employees constantly sick during the year.....	114.62	118.63	233.35
Number of days' relief furnished patients.....			122,472
Cost of subsistence per patient per day.....			\$0.278

## COLON HOSPITAL—Continued.

*Nationality.*

Classes.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Isthmian Canal Commission employees .....	4,463	1,496	4	1,181	1,782
Panama Railroad employees .....	1,321	289	1	186	845
Private pay .....	1,368	439	.....	283	666
Municipal pay .....	87	1	.....	13	73
Zone charity .....	769	104	1	109	555
Total .....	8,008	2,329	6	1,752	3,921

For operations, see report of all surgical operations.

For laboratory report, see consolidated ward laboratory report.

## CULEBRA HOSPITAL.

Classes.	Remaining July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Employees .....	.....	.....	3	1	2	.....	1	1	.....	.....	.....	.....
Nonemployees .....	5	9	92	274	.....	1	94	256	2	18	1	8
Total .....	5	9	95	275	2	1	95	257	2	18	1	8

	White.	Colored.	Total.
Average number of days' treatment for employee for the year .....	8.33	19.00	11.00
Average number of employees constantly sick during the year .....	.07	.05	.12
Number of days' relief furnished patients .....	.....	.....	3,280
Cost of subsistence per patient per day .....	.....	.....	\$0.254

*Nationality.*

Classes.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Employees .....	4	.....	.....	2	2
Nonemployees .....	380	19	6	74	281
Total .....	384	19	6	76	283

For operations, see report of all surgical operations.

For laboratory report, see consolidated ward laboratory report.

## PALO SECO LEPER ASYLUM.

Classes.	Remaining July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Employees.....		1	1	3			1	4				
Pay patients.....	1	25		14		4		3		2	1	30
Charity patients.....		9		6				2				13
Total.....	1	35	1	23		4	1	9		2	1	43

	White.	Colored.	Total.
Average number of days' treatment per employee for the year.....	62.00	45.75	49.00
Average number of employees constantly sick during the year.....	.17	.50	.67
Number of days' relief furnished patients.....			13,611
Cost of subsistence per patient per day.....			\$0.316

## Nationality.

Classes.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Employees.....	5	1			4
Pay patients.....	40			2	38
Charity patients.....	15				15
Total.....	60	1		2	57

## TABOGA SANITARIUM.

Classes.	Remain- ing July 1.	Ad- mitted.	Died.	Dis- charged.	Trans- ferred.	Remain- ing June 30.
Employees.....	66	3,099		3,019	52	94
Families of employees.....	21	731		749	1	2
Total.....	87	3,830		3,768	53	96

Average number of days' treatment per employee for the year.....	7.26
Average number of employees constantly sick during the year.....	61.06
Number of days' relief furnished patients.....	28,519
Cost of subsistence per patient per day.....	\$0.565

## Nationality.

Classes.	Number treated.	Ameri- cans.	Other nations.
Employees.....	3,165	1,868	1,297
Families of employees.....	752	724	28
Total.....	3,917	2,592	1,325

NOTE.—No colored patients treated at Taboga Sanitarium.

## SANTO TOMAS HOSPITAL.

Classes.	Remain- ing July 1.	Ad- mitted.	Died.	Dis- charged.	Trans- ferred.	Remain- ing June 30.
Pay patients .....	28	1,337	26	1,306	.....	33
Charity cases .....	262	5,206	405	4,818	.....	245
Total .....	290	6,543	431	6,124	.....	278

Average number of days' treatment per patient .....	14.14
Average number of patients constantly sick .....	254.03
Number of days' relief furnished patients .....	92,720
Cost of subsistence per patient per day .....	\$0.29

## Nationality.

Classes.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Pay patients .....	1,365	.....	.....	350	1,015
Charity cases .....	5,468	.....	.....	1,072	4,396
Total .....	6,833	.....	.....	1,422	5,411

## Operations.

	Number	Died.
Major .....	544	25
Minor .....	1,203	.....
Total .....	1,747	25

## Dispensary.

Classes.	White.	Colored.	Total.
Natives .....	470	1,741	2,211
Foreigners .....	236	530	766
Total .....	706	2,271	2,977



*Board of health laboratory.*

Bacteriological examinations:		Examinations—Continued.	
Municipal water supplies	130	Yaws suspect	3
Water from springs	7	Sections	14
Water from condensers	216	Bloodstains	1
Water from reservoirs, creeks, and rivers	15	Patient, clinical	1
Culture from oriental sore	1	Chemical examinations:	
Fluid from wrist	2	Silver-nitrate solution	1
Cultures from pustules of arm	1	Rocks	1
Blood cultures	345	Bloodstains	3
Throat cultures (diphtheria suspects)	901	Stomach contents	15
Cultures from autopsies	149	Urine	58
Cultures from eye	2	Water	3
Stools	350	Various liquids, fluids, etc.	119
Urine	344	Various metals	8
Sputum	12	Deposit on boiler	1
Pus	12	Charcoal	1
Eye lesion	1	Arsenic	1
Hydrocele fluid	1	Sugar cane	1
Knee-joint fluid	9	Renal calculus	3
Gall-bladder fluid	3	Sea-coal facing	1
Spinal fluid	15	Agglutination reactions	211
Various amears and specimens	104	Autopsies	785
Pleural fluid	2	Bodies embalmed	61
Cultures from nose and mouth	5	Hydrophobia, preventative treatment	3
Quinine tonic (now formula)	1	Medico-legal post-mortems	4
Blood	1	Sections of tissue prepared, frozen	106
Treponema pallidum	6	Sections of tissue prepared, paraffin	6,260
Scrapings from hands	1	Surgical pathological tissue and neoplasms reported	218
Joint fluid	1	Vaccine inoculations, antityphoid	25
Ulcers on buttock, etc.	2	Vaccine treatment, autogenous	68
Cultures from operating room	68	Water, microscopical examination of	71
Fluid from patellar bursa	1	Water, sanitary analyses of	138
Ankle	1	Urinometer calibrated	1
Pericardial effusion	1	Microscopical examination of lesions on feet	1
Tonsils and adenoids	4	Wasserman reactions	910
Determinations:		Widal reactions	107
Chlorine content in water	200	Stools, microscopical examination of	290
Specific gravity of sea water	1	Vaccination, smallpox	2
Larvacidal and algicidal value of oil larvae	1	Urine, microscopical examination of	1
Coefficient of expansion of fuel oil	1	Blood, microscopical examination of	1
Examinations:		Investigation of cattle sickness at Empire	1
Leper suspects	62	Stomach contents, microscopical examination of	1
Post-mortems, rats and fleas	1		
Post-mortems, dogs	3		

A study of equine trypanosomiasis.

Antochthonous oriental sore in Panama.

A case of oriental sore (Dermal Leishmaniosis) in a native Colombian.

Strongyloides infections in man and animals.

The intestinal worms of 300 insane patients detected by special methods.

Bacillus dysenteriae recovered from the peripheral blood and stools of a case in Panama.

Identification: Examination of flies for B. typhosus.

*Issues of quinine.*

Months.	Kilograms.	Pounds avoirdupois.
July	156.10	344.14
August	74.70	164.68
September	66.30	146.16
October	204.00	449.74
November	49.00	108.03
December	48.50	106.92
January	106.00	233.51
February	42.80	94.36
March	44.50	98.10
April	107.50	237.00
May	41.25	90.94
June	245.50	541.33
Total	1,278.15	2,817.81
Average per month	106.51	234.82

*Sanitation statistics.*

## CITY OF PANAMA.

<b>Anopheles brigade:</b>	
Ditches cleaned.....linear feet..	1,512,737
Ditches dug.....do.....	18,287
Weeds and grass cut and removed, square feet.....	2,071,350
<b>Cesspools—</b>	
Cleaned.....	197
Filled.....	120
Loads of refuse removed from the city.....	6,293
Wells filled.....	17
Earth used in filling cesspools, wells, and holes.....cubic yards..	2,044
Houses on which roof gutters have been corrected.....	331
Gutters repaired or punched, linear feet.....	15,031
Gutters removed.....linear feet..	5,118
Brush cut and burned.....square feet..	1,140,000
Houses from which roof gutters were removed by owners.....	13
Houses on which gutters were repaired by owners.....	20
<b>Disinfection brigade:</b>	
Houses disinfected and fumigated for—	
Beriberi.....	10
Diphtheria.....	33
Malarial fever.....	3
Pernicious fever.....	3
Tuberculosis.....	39
Chickenpox.....	2
Mumps.....	1

<b>Disinfection brigade—Continued:</b>	
Houses disinfected and fumigated for—Continued.	
Scarlet fever.....	2
Leprosy.....	3
Measles.....	6
Typhoid fever.....	7
Septicæmia.....	1
Erysipelas.....	1
Houses disinfected and fumigated at request of Panama Government....	4
Cubic feet disinfected and fumigated..	3,065,920
Rooms disinfected and fumigated....	838
<b>Material used:</b>	
Crude oil.....gallons..	6,530
Larvacide.....do.....	9,830
<b>Destruction of rats:</b>	
Rats caught and killed.....	13,497
Average number of rat traps in use..	379
Poisons placed.....	5,780
<b>Inspection of houses and yards:</b>	
Houses and yards inspected.....	1,310
Persons notified to keep premises in good condition.....	446
Warning notices complied with.....	455
Letters to alcalde requesting enforcement of sanitary rules and regulations.....	89
Shacks, stables, and old buildings condemned and demolished.....	65
New buildings: Plans submitted to health officer and approved.....	307

## COLON, CRISTOBAL, MOUNT HOPE, TORO POINT.

<b>Medical inspection:</b>	
Cases reported by medical inspectors...	69
Cases inspected.....	69
Cases sent to hospital.....	69
Sick children visited.....	1,352
Total number of visits.....	4,131
Number of sick babies sent to hospital.	21
<b>Water and sewers:</b>	
Connections made during the year.....	73
Total number of connections made to date.....	667
Outstanding permits.....	327
Houses in which extensions were made.	60
<b>Houses:</b>	
Plans approved.....	127
Permits to repair, issued.....	370
Permits to occupy, issued.....	68
Temporary permits to occupy, issued..	16
Houses in which defective plumbing fixtures were found and reported to the Superintendent of Public Works.	1,513
<b>Sanitation of Colon:</b>	
Loads of yard garbage removed.....	3,465
Average number of cans of garbage removed daily.....	2,014
Vegetation removed.....acres..	147
Streets cleaned.....do.....	2,648
Private properties cleaned.....	3,210
Pools oiled.....square yards..	226,276
Mosquito breeding places found.....	2,982
Water receptacles treated.....	339,710
Ditches constructed.....linear feet..	6,974
Ditches maintained.....do.....	110,564
Notice to abate nuisances served.....	6,200
Nuisances abated.....	4,836
Buildings inspected.....	45,076

<b>Sanitation of Colon—Continued.</b>	
Alleys cleaned.....	12,220
Alleys cleaned.....square yards..	922,547
Crabholes worked.....	36,800
Loads of refuse hauled from burned section.....	219
<b>Colon and Cristobal garbage disposed of at dump, Colon.</b>	
<b>Sanitation of Cristobal (Including Beach Island):</b>	
Pools oiled.....square yards..	44,208
Water receptacles treated.....	51,740
Mosquito breeding places found.....	476
Crabholes worked.....	900
Ditches constructed.....linear feet..	11,383
Ditches maintained.....do.....	7,944
Vegetation removed.....square yards..	383
<b>Sanitation of Mount Hope:</b>	
Pools oiled.....do.....	456,643
Water receptacles treated.....	370,325
Ditches maintained.....linear feet..	210,064
Crabholes worked.....	14,815
Mosquito breeding places found.....	1,976
Ditches constructed.....linear feet..	21,982
<b>Sanitation of Toro Point:</b>	
Pools oiled.....square yards..	513,770
Water receptacles treated.....	89,543
Mosquito breeding places found.....	1,002
Ditches constructed.....linear feet..	55,515
Ditches maintained.....do.....	103,192
Vegetation removed.....square yards..	35,000
Crabholes worked.....	45,649
Doses quinine tonic distributed.....	75,801
Ditches constructed.....cubic yards..	3,729
Adult mosquitoes killed.....	6,269
Crabs killed.....	905

*Quarantine service.*

## PORTS OF PANAMA-ANCON AND COLON-CRISTOBAL.

Vessels inspected and passed.....	1,266	Persons embarked for foreign ports:	
Vessels detained in quarantine.....	7	Cabin.....	19,123
Vessels fumigated on arrival.....	78	Steorage.....	18,195
Vessels fumigated prior to departure.....	28		37,328
Pieces of baggage disinfected.....	1,044	Apparent decrease for the year from foreign ports:	
Crew inspected.....	104,153	Cabin.....	1 788
Passengers inspected.....	56,446	Steorage.....	* 1,520
			732
Total number of persons inspected....	160,599	Persons arriving from coast towns on small craft.....	31,932
Persons vaccinated at ports of arrival because of compulsory vaccination law.....	10,342	Persons embarked for coast towns on small craft.....	26,902
Persons vaccinated at ports of departure or en route because of compulsory vaccination law.....	13,895	Apparent increase for the year from coast towns.....	5,030
Total number of persons vaccinated....	24,237	Total number of persons landed.....	68,528
Persons held in quarantine at the detention stations to complete period of incubation of yellow fever or plague.....	4,802	Total number of persons embarked.....	64,230
Persons held in quarantine on board vessels to complete period of incubation of yellow fever or plague.....	6,005	Excess over number embarked.....	4,298
Total number of persons held in quarantine.....	10,807	Less number for Pacific ports.....	2,442
Persons landed from foreign ports:		Total apparent increase for the year..	1,856
Cabin.....	19,921	Immigrants recommended for rejection....	103
Steorage.....	16,675	Certificates issued to outgoing passengers..	803
	36,596	Persons refused certificates because of trachoma.....	76
		Bills of health visied.....	604
		Pieces of baggage handled and stored.....	2,867

## BOCAS DEL TORO.

Vessels inspected and passed.....	371	Passengers, in transit, inspected and passed..	3,192
Crew inspected and passed.....	13,822	Persons held to complete period of incubation of yellow fever.....	354
Passengers inspected and passed.....	5,492		

*Personnel report.*

[Average number of employees at work during the year.]

Chief sanitary office.....	43	Dispensaries—Continued.	
Property division.....	9	Cristobal.....	8
Huarantine service.....	40	Culebra.....	13
health office:		Empire.....	11
Panama.....	63	Gatun.....	18
A Colon.....	124	Gorgona.....	9
Ancon Hospital.....	533	Las Cascadas.....	7
Colon Hospital.....	190	Miraflores.....	5
Santo Tomas Hospital.....	5	Nombre de Dios.....	2
Taboga Sanitarium.....	25	Paraiso.....	5
Palo Seco Leper Asylum.....	13	Pedro Miguel.....	5
Zone sanitation.....	254	Porto Bello.....	4
Dispensaries:		San Pablo.....	4
Ancon.....	4	Tabernilla.....	4
Balboa.....	3	Toro Point.....	4
Bas Obispo.....	8		
Bohio.....	2	Total.....	1,418
Corozal.....	3		

*Hospital cases of malaria among employees.*

Months.	Discharged.		Died.		Total cases.	Annual average per 1,000 of deaths.	Annual average per 1,000 of cases.	Em- ployees.
	White.	Colored.	White.	Colored.				
July.....	828	919	5	5	1,757	2.31	406	51,871
August.....	746	675	2	1	1,424	.71	337	50,638
September.....	479	404	1	2	896	.71	211	50,207
October.....	364	253	2	.....	619	.49	150	49,460
November.....	316	241	1	3	561	.99	139	48,260
December.....	305	253	.....	3	561	.74	139	48,396
January.....	180	157	1	1	339	.51	86	47,348
February.....	217	166	1	.....	384	.24	93	49,785
March.....	239	167	.....	1	407	.25	102	47,935
April.....	190	138	1	.....	329	.25	81	48,634
May.....	461	463	1	3	928	.99	230	48,496
June.....	756	991	4	4	1,745	1.96	432	48,519
Total.....	5,081	4,817	19	23	9,940	.85	202	49,129

<sup>1</sup> Increase.<sup>2</sup> Decrease.

## APPENDIX Q.

### REPORT OF F. C. FREEMAN, SUPERINTENDENT, DIVISION OF CLUBHOUSES, DEPARTMENT OF ENGINEERING AND CONSTRUCTION; SECRETARY, INTERNATIONAL COMMITTEE YOUNG MEN'S CHRISTIAN ASSOCIATION OF NORTH AMERICA.

ISTHMIAN CANAL COMMISSION,  
OFFICE OF SUPERINTENDENT OF CLUBHOUSES,  
*Culebra, Canal Zone, August 1, 1911.*

SIR: I have the honor to submit the annual report of the operations during the fiscal year ended June 30, 1911, of the division of clubhouses, as they have been conducted under the supervision of trained secretaries of the Young Men's Christian Association of North America. This division is charged with the recreative and social life of the employees and their families stationed at the seven points where the clubhouses are established.

#### ORGANIZATION.

On June 30, 1911, there were seven clubhouses in operation, extending from Porto Bello, 20 miles down the coast from Colon, to Corozal, about 3 miles from the city of Panama. This makes an addition during the past year of one clubhouse, same being opened at Corozal on January 24, 1911. The type of building is similar to the one opened in April, 1910, at Porto Bello so far as membership privileges are concerned, it providing all the privileges except the bowling alleys, barber shop and locker rooms. In construction, however, it is of an entirely different type, being only one story and following out the open pavilion style of architecture. The clubhouses are located as follows with regard to towns and divisions: Porto Bello, Cristobal and Gatun, in the Atlantic division; Gorgona, Empire, and Culebra, in the central division; Corozal, in the Pacific division.

#### PERSONNEL.

At the end of the fiscal year there were 41 gold employees and 76 silver employees working under this division. Of this number 13 of the gold employees were paid from commission appropriations, while 28 were paid from Young Men's Christian Association funds. Of the silver employees 44 were paid from commission appropriations, while 32 were paid from Young Men's Christian Association funds. The secretarial and clerical force operating the clubhouses was as follows at the close of the year: One superintendent, 7 secretaries, 5 assistant secretaries, 1 special secretary, one clerk, 6 barbers, 10 night clerks, 5 bowling alley night attendants, and 5 pool room night attendants.

### EQUIPMENT.

There had been a great demand for some time past for additional bowling alleys at Empire and Cristobal. In order that the cost of this additional equipment might not become an increased expense to the commission, the advisory committee authorized that the purchase of the additional alleys, the additions to the buildings and the installation of the alleys be paid for from Young Men's Christian Association funds. The total cost of this additional equipment amounted to \$4,762.80. Additional equipment, consisting of phonographs, umbrella racks, library books, bowling and pool equipment, vibrators for barber shops, etc., were added from time to time as the need became evident.

### MEMBERSHIP.

One of the greatest determinants of successful club work is the membership. During the past year the membership of the association on the Canal Zone has been the largest numerically and has had the highest percentage of all possible eligibles that has ever been recorded since the opening of the clubhouses. The average monthly membership for the year was 1,947 as against 1,264 for the previous year; the smallest membership for any given month was 1,712 for July, 1910, as against 1,075 for November, 1909; the largest membership for any given month was 2,121 for January, 1911, as against 1,643 for June, 1910. The average monthly membership percentage of all men eligibles for the year was 60.9 per cent; the lowest percentage for any one month was 54 per cent for July, 1910; the highest was 70.2 per cent for March, 1911. There was no change in the membership dues for the year, they being \$10 for annual, \$6 for semi-annual, and \$4 for quarterly memberships. The policy of extending the privileges of membership to all white gold employees of the Isthmian Canal Commission and Panama Railroad Co. and to white nonemployees upon election has been continued as in the past.

### ACTIVITIES.

Under this heading are grouped the varied interests of the associations as they have been conducted for and by the members. Although the greater part of the work accomplished is of a recreative nature, yet, under this heading will be found many phases of work having for their ultimate objective the building up of the men physically, mentally, and spiritually.

### ENTERTAINMENTS.

From time to time during the year the association has brought lyceum entertainment companies and lecturers from the United States to appear before our Canal Zone audiences. The companies brought down during the year gave 65 entertainments, which had a total attendance of 13,828. These are termed "States entertainments." In addition to the above, 277 local entertainments were given, consisting of moving picture shows, vaudeville, dramatic, minstrel, musical performances, and smokers, with a total attendance of 56,708. The total number of entertainments given during the year was 342 as against 194 for the year 1909-10, with a total attend-

ance of 70,536 as against 38,000 for the previous year. The association also rendered a service to outside organizations which were granted the use of the buildings for 135 entertainments, with an attendance of 16,195. Members were admitted free of charge to all entertainments. The entertainment receipts from nonmembers amounted to \$6,219.35. The total disbursements on account of entertainment amounted to \$10,790.51.

#### BOWLING, BILLIARDS, AND POOL.

Five bowling alleys and seven billiard and pool rooms have been operated throughout the year with a patronage, as shown by the following statistics, considerably in excess of the preceding year. There were 88,085 games bowled on the alleys, an increase over last year of 31,293, while 217,710 games of billiards and pool were played, which is an increase of 37,761 games. There was a monthly average for the year of 12 tournaments of various kinds in progress, with an average monthly enrollment of 194 men.

#### PHYSICAL WORK AND ATHLETICS.

The physical and athletic work conducted by the association during the past year has been nearly doubled as compared with the work done last year. Two athletic meets were conducted under association management, one on September 5, 1910, with 171 entries and thirteen events and the other on February 22, 1911, with 123 entries. The competitors were all employees of the Isthmian Canal Commission or Panama Railroad Co. The winners received gold, silver, and bronze medals, while the winning team received a team trophy. An interassociation basket-ball league was organized and a four-months series of games were played during the latter part of 1910. A series of indoor baseball games, lasting about three months, were played in the early part of the year 1911. A monthly average of 275 different men have been using the gymnasiums during the year as compared with 184 men of last year. Eleven hundred and sixty-five men were enrolled in systematic gymnasium work as against 692, while the total attendance of men using the gymnasium for the year was 20,036 which was an increase of 9,561 over the previous year.

#### RELIGIOUS WORK.

The associations have endeavored to strengthen the religious life on the Zone by cooperating with the churches in whatever way possible and by conducting religious services, Bible and life problem clubs whenever such work could be done without interfering with the organized church work. As a result of effort put forth 143 religious services were held in the clubhouses with a total attendance of 10,773. Last year 42 services were held with an attendance of about 4,000. Eleven months of the year Bible and discussion clubs have been conducted with an average monthly enrollment ranging from 30 to 282.

#### CLUBS AND CLASSES.

In order to better hold the interest of the men in some of the activities, various clubs are organized within the associations. The follow-

ing clubs have been operated throughout the year: Chess and checker clubs, glee clubs, dramatic and minstrel clubs, camera clubs, orchestras, debating and discussion clubs. There also have been some demand for educational work and in an endeavor to meet same, classes have been organized in Spanish, mechanical drawing, air brakes, and mathematics.

#### LIBRARIES, READING ROOMS, AND CORRESPONDENCE TABLES.

The libraries and reading rooms have been a very popular feature with the membership. About 65 of the leading magazines, journals, scientific periodicals, and newspapers are to be found in the reading room of each association, while the libraries to which new books are added from time to time, range from 500 to 1,200 volumes each. There was an average monthly enrollment in the library of 804 members, while a total of 30,837 books were withdrawn. The total expenditure for this branch of the work was \$3,208.68. An average of 221 letters per day, or a grand total of about 80,948 for the year, were written at the correspondence tables.

#### REFRESHMENT COUNTERS.

The refreshment counters continue to be one of the greatest social and most highly appreciated features of the work. The membership and their friends have the opportunity of purchasing at moderate prices ice cream, soft drinks, and short-order luncheons. The receipts for the year were \$36,421.08, as compared with \$25,025.54 for the preceding year.

#### BARBER SHOPS AND PRESSING CLUBS.

Six barber shops and six pressing clubs were operated for the benefit of the members at reasonable rates, and the patronage has been evidence of their success.

#### DORMITORIES.

A real service has been rendered to both members and nonmembers by the fact that the clubhouses are provided with cots and mattresses and are thus enabled to furnish lodgings to employees called away from their homes for the night and to tourists visiting the canal. During the year 5,579 men were housed for the night.

#### COMMITTEES.

The activities of the associations are divided into various classes and each class is represented by a committee of members who cooperate with the secretaries in building up their particular branch of the work. There are committees on bowling, billiards and pool, entertainment, athletics, religious work, library and reading room, small games committee, membership committee, and the visitation committee. The last mentioned is one of the most important, as the members make it a practice of calling on men in the hospitals at least once each week. During the year 3,384 men were called on by

the secretaries and members of this committee. There was an average of 218 men serving on committees each month.

#### BOYS' DEPARTMENT.

The work of this department, which has been carried on for boys from 10 to 16 years of age, has proved very satisfactory. The average monthly membership has been 93. Fifty-seven outings have been given this department and the average monthly attendance at the gymnasium has been 562.

#### PRIVILEGES FOR WOMEN.

That the clubhouses might prove an institution rendering service to the entire community, membership privileges, without the payment of dues, have been extended to the women two afternoons each week. The women's clubs have also made the clubhouses their headquarters. During the year women were invited to 446 evening functions aggregating an attendance of 29,087.

#### ATTENDANCE.

As a result of actual counts and careful monthly estimates, the records show a total attendance at the buildings for the year of about 883,206. This is an increase over the report of last year by about 285,000.

#### FINANCES.

The operating expenses of the clubhouses paid from commission appropriations were \$51,193.90, while the expenses paid from Young Men's Christian Association funds were \$81,510.51, making a total operating expense for the division of \$132,704.41. The gross receipts for the year were \$91,723.76, or an average of \$7,643.65 per month. The total receipts exceeded those of last year by \$26,750.64. The available total balance on hand at the close of the year, not taking into consideration the estimated liabilities, was \$21,313.90.

#### EXECUTIVE COUNCILS AND ADVISORY COMMITTEE.

The general supervision of the detailed work of each association is vested in a body of men picked from the membership of their respective clubs and appointed by the international committee of the Young Men's Christian Association as members of a body known as the executive council. Their duties are of an advisory and administrative nature, cooperating with the local secretaries. The following men are the chairmen of these local councils: Corozal, Mr. J. M. G. Watt; Culebra, Mr. E. E. Lee; Empire, Mr. A. S. Zinn; Gorgona, Mr. LeRoy Smith; Gatun, Lieut. Col. Wm. L. Sibert; Cristobal, Judge Thomas E. Brown, jr.; Porto Bello, Mr. A. C. Cornelison.

The advisory committee, consisting of the following members, Col. W. C. Gorgas, chief sanitary officer; Mr. W. W. Warwick, examiner of accounts; Mr. Joseph Bucklin Bishop, secretary of the Isthmian Canal Commission; Chaplain H. A. Brown, and Mr. F. C.



Freeman, general secretary, Young Men's Christian Association, was appointed by the chairman and chief engineer, and was made responsible for the property of the commission represented by the clubhouses. Their further duties consisted of appropriating budgets from Young Men's Christian Association funds upon the recommendation of the executive councils and advising with the superintendent of clubhouses on all matters of a general nature.

Respectfully submitted.

F. C. FREEMAN,  
*Superintendent of Clubhouses.*

Col. GEORGE W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

## APPENDIX R.

### REPORT OF MAJ. F. C. BOGGS, CORPS OF ENGINEERS, UNITED STATES ARMY, GENERAL PURCHASING OFFICER AND CHIEF OF THE WASHINGTON OFFICE.

ISTHMIAN CANAL COMMISSION,  
*Washington, D. C., July 24, 1911.*

SIR: I have the honor to submit the following report upon the work in this office during the fiscal year ending June 30, 1911:

There have been no changes in the organization of the office since the last annual report, the following divisions, all under my charge as general purchasing officer and chief of office of the Isthmian Canal Commission, being still maintained: General office, disbursing office, office of assistant examiner of accounts, appointment division, correspondence and record division, and purchasing department.

There has been a slight decrease in the total number of appointments in the United States to positions on the Isthmus as compared with the number made during the preceding year. In view of this decrease, and the further fact that from now on probably fewer men will be appointed in the United States due to the early completion of the canal, the employment agency heretofore maintained in New York City was abolished on May 15, 1911. All appointees selected in the United States are now secured solely through the Washington office of the commission. During the past year the Washington office and its agents were called upon to secure on short notice a large number of boiler makers to fill vacancies caused by wholesale resignations on the Isthmus. As a result about 140 men were recruited and sent to the Isthmus within approximately 6 weeks. The number of informal inquiries received daily from prospective applicants for employment continues to be heavy, as evidenced by the figures given below, covering circulars and letters mailed, which are in excess of the number sent out last year. Although the annual number of appointees is gradually lessening, the class of employees required is now usually along special lines of experience and often with high technical education and training, which results in their being much more difficult to secure than the ordinary class of skilled workmen. Present requisitions for men, although for smaller numbers, require comparatively more correspondence and greater efforts on the part of the Washington office to fill than was the case in past years with heavy requisitions for merely skilled tradesmen. During the last 12 months 1,706 persons within the United States have been tendered employment on the Isthmus in grades above that of laborer; 1,083 accepted and were appointed, covering 58 different positions; 5,791 persons, including new appointees, those returning from leave of absence, and members of employees' families, have been provided

with transportation from the United States to the Isthmus, and in response to inquiries and applications for employment during this period, and in the issuance of appointments, 21,730 letters have been written, 2,996 telegrams sent, and 21,639 circulars mailed.

The work of the correspondence and record division, in which is conducted all general or administrative correspondence, etc., has been continued as described in the last annual report.

The disbursing office has continued its operations in the same manner as indicated in previous annual reports, and the following shows its transactions during the past fiscal year:

*Claim statement.*

On hand July 1.....	112
Received July 1 to June 30.....	13, 722
<b>Total.....</b>	<b>13, 834</b>
Passed for settlement July 1 to June 30.....	13, 792
On hand June 30.....	42

*Financial statement.*

On hand July 1, 1910.....	\$881, 340. 93
Receipts:	
From United States Treasury.....	\$12, 015, 000. 00
Liquidated damages.....	25, 380. 55
Cash discounts.....	1, 677. 78
Miscellaneous collections.....	54, 019. 05
	<u>12, 096, 077. 38</u>
	<u>12, 977, 418. 31</u>
Disbursements:	
Claims paid.....	11, 306, 762. 95
Deposits to "Miscellaneous receipts".....	49, 721. 47
Repayments to appropriations.....	1, 059, 275. 91
	<u>12, 415, 760. 33</u>
Balance on hand June 30, 1911.....	<u>561, 657. 98</u>
	<u>12, 977, 418. 31</u>

Claims aggregating \$102,854.31, which were examined in the disbursing office and settled by the Auditor for the War Department either by direct or transfer settlements, are not included in the above statement.

The assistant examiner's office has continued the work of administratively examining the vouchers paid by the disbursing officer, and verifying monthly the cash and net balances appearing on his accounts current.

The expenditures have been classified on weekly abstracts transmitted to the Isthmus, the annual inventory of commission property in the United States taken and verified, and the work incident to claims of injured employees arising under the act of May 30, 1908, has been handled by said office.

Moneys deposited and reappropriated under the act of March 4, 1909, have been checked, as also all collections made by the disbursing officer at Washington.

Monthly statements of Treasury Department and disbursing office balances, and statements of sales of scrap, and other statements of

miscellaneous character have been prepared and transmitted to the Isthmus.

The work involved in the preparation of commission contracts and bonds, including the legal work appertaining thereto, has been performed by the assistant examiner of accounts in the same manner as during the last fiscal year.

In addition to the legal work incident to the preparation and execution of commission contracts and bonds, the assistant examiner of accounts has generally acted as legal advisor to the commission in the United States and has assisted the Attorney General's office in preparing defenses to suits brought by commission contractors against the Government in the Court of Claims and the circuit courts.

The method of purchasing supplies through the purchasing department under supervision of the general purchasing officer, with headquarters at Washington, D. C., and with an assistant purchasing officer located in New York and assistant purchasing agents at New Orleans and San Francisco, has continued on the same basis as described in previous annual reports. Purchases are made through circular invitations and advertising for bids, as heretofore, and the method of purchasing under annual contracts has been carried out during the past year as in the previous year, with the same satisfactory results. Annual contracts for most of the supplies for the fiscal year ending June 30, 1912, have been placed and include such materials as dynamite, railroad ties, structural and bar iron, track material, and other staple articles used in the maintenance and repair of machinery and equipment.

The materials and supplies purchased undergo a preliminary inspection in the United States before shipment to the Isthmus, this work being carried on by a force of inspectors employed by the commission, with the assistance of the officers of the Corps of Engineers, United States Army, located throughout the country, who make inspections which can be conveniently handled by their offices. Valuable assistance in connection with the work of the purchasing department has also been rendered by the Bureau of Mines, Bureau of Chemistry, United States navy yard laboratories, Bureau of Standards, and the Medical, Quartermaster, Subsistence, and Ordnance Departments of the United States Army.

The total amount covered by orders placed during the fiscal year ended June 30, 1911, was \$6,976,066.59. The most important contracts placed during the year were for six emergency dams for the canal locks, amounting to \$2,238,988.40, and for the machinery and materials entering into the permanent construction and operation of the canal locks, amounting to approximately \$2,456,482.23. The other principal items purchased were: One twin-screw steel-ladder dredge with a hopper capacity of 1,200 tons of spoil, 2 locomotive cranes, 1 electric trolley crane, 12 concrete mixers, 2 narrow-gauge locomotives, 1 unloader plow, 19,577,589 feet of lumber, 3,400 tons steel rails, 2,775 piles, and 8,000 frames for concrete piles. The contracts for the machinery to operate the valves in the canal locks and the miter gate moving machines and miter forcing machines for the lock gates include options covering the purchase of certain additional machines required, which options when exercised will increase by approximately \$1,525,301 the total purchases negotiated during

the past year, although the supplemental orders therefor will be placed in the current year.

During the past year three independent inspecting offices have been established, covering inspection of the lock gates, machinery, and materials which will enter into the construction of the locks and the movable dams, contracts for which extend over a considerable period of time. While the inspectors in charge of these offices report directly to the Isthmus in matters relating to constructive details, they are under the control of this office regarding matters of administration and settlement of questions arising under the various contracts. This work, in connection with the inspection and forwarding of cement, will continue until near the completion of the canal, and adds materially to the current work of the purchasing department.

Very respectfully,

F. C. Boggs,  
*Major, Corps of Engineers, United States Army,*  
*General Purchasing Officer, Chief of Office.*

Col. GEO. W. GOETHALS, U. S. Army,  
*Chairman and Chief Engineer, Culebra, Canal Zone.*

## APPENDIX S.

### CHARTS SHOWING ORGANIZATION OF ISTHMIAN CANAL COMMISSION AND PANAMA RAILROAD CO., JULY, 1911.

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(For plates, see portfolio.)

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## APPENDIX T.

### TREATIES AND ACTS OF CONGRESS RELATING TO THE ISTHMIAN CANAL.

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## TREATIES AND ACTS OF CONGRESS RELATING TO THE ISTHMIAN CANAL.

Convention as to ship-canal connecting Atlantic and Pacific Oceans, 1850. (Clayton-Bulwer Treaty.) Concluded April 19, 1850; ratification advised by the Senate May 22, 1850; ratified by the President May 23, 1850; ratifications exchanged July 4, 1850; proclaimed July 5, 1850. (Treaties and Conventions, 1889, p. 440.)

### ARTICLES.

I. Declarations as to control of canal, occupation of territory, and commercial advantages.

II. Neutrality of canal in case of war.

III. Protection of construction.

IV. Mutual influence to facilitate construction.

V. Guarantee of neutrality.

VI. Cooperation of other States.

VII. Mutual encouragement to speedy construction.

VIII. Protection to other communications.

IX. Ratification.

The United States of America and Her Britannic Majesty, being desirous of consolidating the relations of amity which is so happily subsist between them, by setting forth and fixing in a Convention their views and intentions with reference to any means of communication by ship canal, which may be constructed between the Atlantic and Pacific Oceans by the way of the River San Juan de Nicaragua and either or both of the Lakes of Nicaragua or Managua, to any port or place on the Pacific Ocean,—The President of the United States has conferred full powers on John M. Clayton, Secretary of State of the United States; and Her Britannic Majesty on the Right Honorable Sir Henry Lytton Bulwer, a member of Her Majesty's Most Honorable Privy Council, Knight Commander of the Most Honorable Order of the Bath, and Envoy Extraordinary and Minister Plenipotentiary of Her Britannic Majesty to the United States, for the aforesaid purpose; and the said Plenipotentiaries having exchanged their full powers, which were found to be in proper form, have agreed to the following articles:

### ARTICLE I.

The Governments of the United States and Great Britain hereby declare, that neither the one nor the other will ever obtain or maintain for itself any exclusive control over the said Ship Canal; agreeing that neither will ever erect or maintain any fortifications commanding the same, or in the vicinity thereof, or occupy, or fortify, or colonize, or assume or exercise any dominion over Nicaragua, Costa Rica, the Mosquito Coast, or any part of Central America; nor will either make use of any protection which either affords or may afford, or any alliance which either has or may have, to or with any State or People for the purpose of erecting or maintaining any such fortifications, or of occupying, fortifying, or colonizing Nicaragua, Costa Rica, the Mosquito Coast, or any part of Central America, or of assuming or exercising dominion over the same; nor will the United States or Great Britain take advantage of any intimacy, or use any alliance, connection or influence that either may possess with any State or Government through whose territory the said Canal may pass, for the purpose of acquiring or holding, directly or indirectly, for the citizens or subjects of the one, any rights or advantages in regard to commerce or navigation through the said canal which shall not be offered on the same terms to the citizens or subjects of the other.

## ARTICLE II.

Vessels of the United States or Great Britain, traversing the said Canal shall, in case of war between the contracting parties, be exempted from blockade, detention or capture, by either of the belligerents; and this provision shall extend to such a distance from the two ends of the said Canal as may hereafter be found expedient to establish.

## ARTICLE III.

In order to secure the construction of the said Canal, the contracting parties engage that, if any such Canal shall be undertaken upon fair and equitable terms by any parties having the authority of the local Government or Governments through whose territory the same may pass, then the persons employed in making the said Canal and their property used, or to be used, for that object, shall be protected, from the commencement of the said Canal to its completion, by the Governments of the United States and Great Britain, from unjust detention, confiscation, seizure or any violence whatsoever.

## ARTICLE IV.

The contracting parties will use whatever influence they respectively exercise, with any State, States or Governments possessing, or claiming to possess, any jurisdiction or right over the territory which the said Canal shall traverse, or which shall be near the waters applicable thereto; in order to induce such States, or Governments, to facilitate the construction of the said Canal by every means in their power; and furthermore, the United States and Great Britain agree to use their good offices, wherever or however it may be most expedient, in order to procure the establishment of two free Ports,—one at each end of the said Canal.

## ARTICLE V.

The contracting parties further engage that, when the said Canal shall have been completed they will protect it from interruption, seizure or unjust confiscation, and that they will guarantee the neutrality thereof, so that the said Canal may forever be open and free, and the capital invested therein, secure. Nevertheless, the Governments of the United States and Great Britain, in according their protection to the construction of the said Canal, and guaranteeing its neutrality and security when completed, always understand that, this protection and guarantee are granted conditionally, and may be withdrawn by both Governments, or either Government, if both Governments or either Government, should deem that the persons or company, undertaking or managing the same, adopt or establish such regulations concerning the traffic thereupon, as are contrary to the spirit and intention of this Convention,—either by making unfair discriminations in favor of the commerce of one of the contracting parties over the commerce of the other, or by imposing oppressive exactions or unreasonable tolls upon passengers, vessels, goods, wares, merchandise, or other articles. Neither party, however, shall withdraw the aforesaid protection and guarantee without first giving six months notice to the other.

## ARTICLE VI.

The contracting parties in this Convention engage to invite every State with which both or either have friendly intercourse, to enter into stipulations with them similar to those which they have entered into with each other; to the end that all other States may share in the honor and advantage of having contributed to a work of such general interest and importance as the Canal herein contemplated. And the contracting parties likewise agree that, each shall enter into Treaty stipulations with such of the Central American States, as they may deem advisable, for the purpose of more effectually carrying out the great design of this Convention, namely,—that of constructing and maintaining the said Canal as a ship-communication between the two Oceans, for the benefit of mankind, on equal terms to all, and of protecting the same; and they, also, agree that, the good offices of either shall be employed, when requested by the other, in aiding and assisting the negotiations of such treaty stipulations; and, should any differences arise as to right or property over the territory through which the said

Canal shall pass,—between the States or Governments of Central America,—and such differences should, in any way, impede or obstruct the execution of the said Canal, the Governments of the United States and Great Britain will use their good offices to settle such differences in the manner best suited to promote the interests of the said Canal, and to strengthen the bonds of friendship and alliance which exist between the contracting parties.

## ARTICLE VII.

It being desirable that no time should be unnecessarily lost in commencing and constructing the said Canal, the Governments of the United States and Great Britain determine to give their support and encouragement to such persons, or company, as may first offer to commence the same, with the necessary capital, the consent of the local authorities, and on such principles as accord with the spirit and intention of this Convention; and if any persons, or company, should already have, with any State through which the proposed Ship-Canal may pass, a contract for the construction of such a canal as that specified in this Convention,—to the stipulations of which contract neither of the contracting parties in this convention have any just cause to object,—and the said persons, or company, shall moreover, have made preparations and expended time, money, and trouble on the faith of such contract, it is hereby agreed that such persons, or company, shall have a priority of claim over every other person, persons, or company to the protection of the Governments of the United States and Great Britain, and be allowed a year, from the date of the exchange of the ratifications of this Convention for concluding their arrangements, and presenting evidence of sufficient capital subscribed to accomplish the contemplated undertaking; it being understood, that if, at the expiration of the aforesaid period, such persons, or company be not able to commence and carry out the proposed enterprise, then the Governments of the United States and Great Britain shall be free to afford their protection to any other persons, or company, that shall be prepared to commence and proceed with the construction of the Canal in question.

## ARTICLE VIII.

The Governments of the United States and Great Britain having not only desired in entering into this Convention, to accomplish a particular object, but, also, to establish a general principle, they hereby agree to extend their protection, by Treaty stipulations, to any other practicable communications, whether by Canal or rail-way, across the Isthmus which connects North and South America; and, especially to the inter-oceanic communications,—should the same prove to be practicable, whether by Canal or rail-way,—which are now proposed to be established by the way of Tehuantepec, or Panama. In granting, however, their joint protection to any such Canals or rail-ways, as are by this Article specified, it is always understood by the United States and Great Britain, that the parties constructing or owning the same, shall impose no other charges or conditions of traffic thereupon, than the aforesaid Governments shall approve of, as just and equitable; and, that the same Canals or rail-ways, being open to the citizens and subjects of the United States and Great Britain on equal terms, shall, also, be open on like terms to the citizens and subjects of every other State which is willing to grant thereto, such protection as the United States and Great Britain engage to afford.

## ARTICLE IX.

The ratifications of this Convention shall be exchanged at Washington, within six months from this day, or sooner, if possible.

In faith whereof, we, the respective Plenipotentiaries, have signed this Convention, and have hereunto affixed our Seals.

Done, at Washington, the nineteenth day of April, Anno Domini one thousand eight hundred and fifty.

JOHN M. CLAYTON. [SEAL.]  
HENRY LYTTON BULWER. [SEAL.]

Treaty between the United States and Great Britain to facilitate the construction of a ship canal. Signed at Washington, November 18, 1901; ratification advised by the Senate, December 16, 1901; ratified by the President, December 26, 1901; ratified by Great Britain, January 20, 1902; ratifications exchanged at Washington, February 21, 1902; proclaimed, February 22, 1902.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

### A PROCLAMATION.

Whereas, a Convention between the United States of America and the United Kingdom of Great Britain and Ireland, to facilitate the construction of a ship canal to connect the Atlantic and Pacific Oceans, by whatever route may be considered expedient, and to that end to remove any objection which may arise out of the Convention of the 19th April, 1850, commonly called the Clayton-Bulwer treaty, to the construction of such canal under the auspices of the Government of the United States, without impairing the "general principle" of neutralization established in Article VIII of that Convention, was concluded and signed by their respective plenipotentiaries at the city of Washington on the 18th day of November, 1901, the original of which Convention is word for word as follows:

The United States of America and His Majesty Edward the Seventh, of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, King, and Emperor of India, being desirous to facilitate the construction of a ship canal to connect the Atlantic and Pacific Oceans, by whatever route may be considered expedient, and to that end to remove any objection which may arise out of the Convention of the 19th April, 1850, commonly called the Clayton-Bulwer Treaty, to the construction of such canal under the auspices of the Government of the United States, without impairing the "general principle" of neutralization established in Article VIII of that Convention, have for that purpose appointed as their Plenipotentiaries:

The President of the United States, John Hay, Secretary of State of the United States of America;

And His Majesty Edward the Seventh, of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, King, and Emperor of India, the Right Honourable Lord Pauncefoot, G. C. B., G. C. M. G., His Majesty's Ambassador Extraordinary and Plenipotentiary to the United States;

Who, having communicated to each other their full powers which were found to be in due and proper form, have agreed upon the following Articles:—

#### ARTICLE I.

The High Contracting Parties agree that the present Treaty shall supersede the afore-mentioned Convention of the 19th April, 1850.

#### ARTICLE II.

It is agreed that the canal may be constructed under the auspices of the Government of the United States, either directly at its own cost, or by gift or loan of money to individuals or Corporations, or through subscription to or purchase of stock or shares, and that, subject to the provisions of the present Treaty, the said Government shall have and enjoy all the rights incident to such construction, as well as the exclusive right of providing for the regulation and management of the canal.

#### ARTICLE III.

The United States adopts, as the basis of the neutralization of such ship canal, the following Rules, substantially as embodied in the Convention of Constantinople, signed the 28th October, 1888, for the free navigation of the Suez Canal, that is to say:

1. The canal shall be free and open to the vessels of commerce and of war of all nations observing these Rules, on terms of entire equality, so that there shall be no discrimination against any such nation, or its citizens or subjects, in respect of the conditions or charges of traffic, or otherwise. Such conditions and charges of traffic shall be just and equitable.

2. The canal shall never be blockaded, nor shall any right of war be exercised nor any act of hostility be committed within it. The United States, however, shall be at liberty to maintain such military police along the canal as may be necessary to protect it against lawlessness and disorder.

3. Vessels of war of a belligerent shall not revictual nor take any stores in the canal except so far as may be strictly necessary; and the transit of such vessels through the canal shall be effected with the least possible delay in accordance with the Regulations in force, and with only such intermission as may result from the necessities of the service.

Prizes shall be in all respects subject to the same Rules as vessels of war of the belligerents.

4. No belligerent shall embark or disembark troops, munitions of war, or warlike materials in the canal, except in case of accidental hindrance of the transit, and in such case the transit shall be resumed with all possible dispatch.

5. The provisions of this Article shall apply to waters adjacent to the canal, within 3 marine miles of either end. Vessels of war of a belligerent shall not remain in such waters longer than twenty-four hours at any one time, except in case of distress, and in such case, shall depart as soon as possible; but a vessel of war of one belligerent shall not depart within twenty-four hours from the departure of a vessel of war of the other belligerent.

6. The plant, establishments, buildings, and all works necessary to the construction, maintenance, and operation of the canal shall be deemed to be part thereof, for the purposes of this Treaty, and in time of war, as in time of peace, shall enjoy complete immunity from attack or injury by belligerents, and from acts calculated to impair their usefulness as part of the canal.

#### ARTICLE IV.

It is agreed that no change of territorial sovereignty or of the international relations of the country or countries traversed by the before-mentioned canal shall affect the general principle of neutralization or the obligation of the High Contracting Parties under the present Treaty.

#### ARTICLE V.

The present Treaty shall be ratified by the President of the United States, by and with the advice and consent of the Senate thereof, and by His Britannic Majesty; and the ratifications shall be exchanged at Washington or at London at the earliest possible time within six months from the date hereof.

In faith whereof the respective Plenipotentiaries have signed this Treaty and thereunto affixed their seals.

Done in duplicate at Washington, the 18th day of November, in the year of Our Lord one thousand nine hundred and one.

JOHN HAY. [SEAL.]  
PAUNCEFOTE. [SEAL.]

And Whereas the said Convention has been duly ratified on both parts, and the ratification of the two Governments were exchanged in the city of Washington on the twenty-first day of February, one thousand nine hundred and two;

Now, therefore, be it known that I, Theodore Roosevelt, President of the United States of America, have caused the said Convention to be made public, to the end that the same and every article and clause thereof may be observed and fulfilled with good faith by the United States and the citizens thereof.

In witness whereof I have hereunto set my hand and caused the seal of the United States to be affixed.

Done at the City of Washington, this twenty-second day of February, in the year of Our Lord one thousand nine hundred and two, and of the Independence of the United States the one hundred and twenty-sixth.

[SEAL.]

By the President:

JOHN HAY,  
*Secretary of State.*

THEODORE ROOSEVELT.

An Act To provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the President of the United States is hereby authorized to acquire, for and on behalf of the United States, at a cost not exceeding forty millions of dollars, the rights, privileges, franchises, concessions, grants of land, right of

way, unfinished work, plants, and other property, real, personal, and mixed, of every name and nature, owned by the New Panama Canal Company, of France, on the Isthmus of Panama, and all its maps, plans, drawings, records on the Isthmus of Panama and in Paris, including all the capital stock, not less, however, than sixty-eight thousand eight hundred and sixty-three shares of the Panama Railroad Company, owned by or held for the use of said canal company, provided a satisfactory title to all of said property can be obtained.

Sec. 2. That the President is hereby authorized to acquire from the Republic of Colombia, for and on behalf of the United States, upon such terms as he may deem reasonable, perpetual control of a strip of land, the territory of the Republic of Colombia, not less than six miles in width, extending from the Caribbean Sea to the Pacific Ocean, and the right to use and dispose of the waters thereon, and to excavate, construct, and to perpetually maintain, operate, and protect thereon a canal, of such depth and capacity as will afford convenient passage of ships of the greatest tonnage and draft now in use, from the Caribbean Sea to the Pacific Ocean, which control shall include the right to perpetually maintain and operate the Panama Railroad, if the ownership thereof, or a controlling interest therein, shall have been acquired by the United States, and also jurisdiction over said strip and the ports at the ends thereof to make such police and sanitary rules and regulations as shall be necessary to preserve order and preserve the public health thereon, and to establish such judicial tribunals as may be agreed upon thereon as may be necessary to enforce such rules and regulations.

The President may acquire such additional territory and rights from Colombia as in his judgment will facilitate the general purpose hereof.

Sec. 3. That when the President shall have arranged to secure a satisfactory title to the property of the New Panama Canal Company, as provided in section one hereof, and shall have obtained by treaty control of the necessary territory from the Republic of Colombia, as provided in section two hereof, he is authorized to pay for the property of the New Panama Canal Company forty millions of dollars and to the Republic of Colombia such sum as shall have been agreed upon, and a sum sufficient for both said purposes is hereby appropriated, out of any money in the Treasury not otherwise appropriated, to be paid on warrant or warrants drawn by the President.

The President shall then through the Isthmian Canal Commission hereinafter authorized cause to be excavated, constructed, and completed, utilizing to that end as far as practicable the work heretofore done by the New Panama Canal Company, of France, and its predecessor company, a ship canal from the Caribbean Sea to the Pacific Ocean. Such canal shall be of sufficient capacity and depth as shall afford convenient passage for vessels of the largest tonnage and greatest draft now in use, and such as may be reasonably anticipated, and shall be supplied with all necessary locks and other appliances to meet the necessities of vessels passing through the same from ocean to ocean; and he shall also cause to be constructed such safe and commodious harbors at the termini of said canal, and make such provisions for defense as may be necessary for the safety and protection of said canal and harbors. That the President is authorized for the purposes aforesaid to employ such persons as he may deem necessary, and to fix their compensation.

Sec. 4. That should the President be unable to obtain for the United States a satisfactory title to the property of the New Panama Canal Company and the control of the necessary territory of the Republic of Colombia and the rights mentioned in sections one and two of this Act, within a reasonable time and upon reasonable terms, then the President, having first obtained for the United States perpetual control by treaty of the necessary territory from Costa Rica and Nicaragua, upon terms which he may consider reasonable, for the construction, perpetual maintenance, operation, and protection of a canal connecting the Caribbean Sea with the Pacific Ocean by what is commonly known as the Nicaragua route, shall through the said Isthmian Canal Commission cause to be excavated and constructed a ship canal and waterway from a point on the shore of the Caribbean Sea near Greytown, by way of Lake Nicaragua, to a point near Brito on the Pacific Ocean. Said canal shall be of sufficient capacity and depth to afford convenient passage for vessels of the largest tonnage and greatest draft now in use, and such as may be reasonably anticipated, and shall be supplied with all necessary locks and other appliances to meet the necessities of vessels passing through the same from ocean to ocean; and he shall also construct such safe and commodious harbors at the termini of said canal as shall be necessary for the safe and convenient use thereof, and shall make such provisions for defense as may be necessary for the safety and protection of said harbors and canal; and such sum or sums of money as may be agreed upon by such treaty as compensation to be paid to Nicaragua and Costa Rica for the concessions and rights hereunder provided to be acquired by the United States, are hereby appropriated, out of any

money in the Treasury not otherwise appropriated, to be paid on warrant or warrants drawn by the President.

The President shall cause the said Isthmian Canal Commission to make such surveys as may be necessary for said canal and harbors to be made, and in making such surveys and in the construction of said canal may employ such persons as he may deem necessary, and may fix their compensation.

In the excavation and construction of said canal the San Juan River and Lake Nicaragua, or such parts of each as may be made available, shall be used.

SEC. 5. That the sum of ten million dollars is hereby appropriated, out of any money in the Treasury not otherwise appropriated, toward the project herein contemplated by either route so selected.

And the President is hereby authorized to cause to be entered into such contract or contracts as may be deemed necessary for the proper excavation, construction, completion, and defense of said canal, harbors, and defenses, by the route finally determined upon under the provisions of this Act. Appropriations therefor shall from time to time be hereafter made, not to exceed in the aggregate the additional sum of one hundred and thirty-five millions of dollars should the Panama route be adopted, or one hundred and eighty millions of dollars should the Nicaragua route be adopted.

SEC. 6. That in any agreement with the Republic of Colombia, or with the States of Nicaragua and Costa Rica, the President is authorized to guarantee to said Republic or to said States the use of said canal and harbors, upon such terms as may be agreed upon, for all vessels owned by said States or by citizens thereof.

SEC. 7. That to enable the President to construct the canal and works appurtenant thereto as provided in this Act, there is hereby created the Isthmian Canal Commission, the same to be composed of seven members, who shall be nominated and appointed by the President, by and with the advice and consent of the Senate, and who shall serve until the completion of said canal unless sooner removed by the President, and one of whom shall be named as the chairman of said Commission. Of the seven members of said Commission at least four of them shall be persons learned and skilled in the science of engineering, and of the four at least one shall be an officer of the United States Army, and at least one other shall be an officer of the United States Navy, the said officers respectively being either upon the active or the retired list of the Army or of the Navy. Said commissioners shall each receive such compensation as the President shall prescribe until the same shall have been otherwise fixed by the Congress. In addition to the members of said Isthmian Canal Commission, the President is hereby authorized through said Commission to employ in said service any of the engineers of the United States Army at his discretion, and likewise to employ any engineers in civil life, at his discretion, and any other persons necessary for the proper and expeditious prosecution of said work. The compensation of all such engineers and other persons employed under this Act shall be fixed by said Commission, subject to the approval of the President. The official salary of any officer appointed or employed under this Act shall be deducted from the amount of salary or compensation provided by or which shall be fixed under the terms of this Act. Said Commission shall in all matters be subject to the direction and control of the President, and shall make to the President annually and at such other periods as may be required, either by law or by the order of the President, full and complete reports of all their actings and doings and of all moneys received and expended in the construction of said work and in the performance of their duties in connection therewith, which said reports shall be by the President transmitted to Congress. And the said Commission shall furthermore give to Congress, or either House of Congress, such information as may at any time be required either by Act of Congress or by the order of either House of Congress. The President shall cause to be provided and assigned for the use of the Commission such offices as may, with the suitable equipment of the same, be necessary and proper, in his discretion, for the proper discharge of the duties thereof.

SEC. 8. That the Secretary of the Treasury is hereby authorized to borrow on the credit of the United States from time to time, as the proceeds may be required to defray expenditures authorized by this Act (such proceeds when received to be used only for the purpose of meeting such expenditures), the sum of one hundred and thirty million dollars, or so much thereof as may be necessary, and to prepare and issue therefor coupon or registered bonds of the United States in such form as he may prescribe, and in denominations of twenty dollars or some multiple of that sum, redeemable in gold coin at the pleasure of the United States after ten years from the date of their issue, and payable thirty years from such date, and bearing interest payable quarterly in gold coin at the rate of two per centum per annum; and the bonds herein authorized shall be exempt from all taxes or duties of the United States,



as well as from taxation in any form by or under State, municipal, or local authority: *Provided*, That said bonds may be disposed of by the Secretary of the Treasury at not less than par, under such regulations as he may prescribe, giving to all citizens of the United States an equal opportunity to subscribe therefor, but no commissions shall be allowed or paid thereon; and a sum not exceeding one-tenth of one per centum of the amount of the bonds herein authorized is hereby appropriated, out of any money in the Treasury not otherwise appropriated, to pay the expense of preparing, advertising, and issuing the same.

Approved, June 28, 1902. [32 U. S. Stats., 481.]

[Copy of Convention between the United States and the Republic of Panama for the construction of a Ship Canal to connect the waters of the Atlantic and Pacific Oceans.]

#### PANAMA—SHIP CANAL.

#### CONVENTION

BETWEEN THE UNITED STATES AND THE REPUBLIC OF PANAMA FOR THE CONSTRUCTION OF A SHIP CANAL TO CONNECT THE WATERS OF THE ATLANTIC AND PACIFIC OCEANS.

Signed at Washington, November 18, 1903.

Ratification advised by the Senate, February 23, 1904.

Ratified by the President, February 25, 1904.

Ratified by Panama, December 2, 1903.

Ratifications exchanged at Washington, February 26, 1904.

Proclaimed, February 26, 1904.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

#### A PROCLAMATION.

Whereas, a Convention between the United States of America and the Republic of Panama to insure the construction of a ship canal across the Isthmus of Panama to connect the Atlantic and Pacific Oceans, was concluded and signed by their respective Plenipotentiaries at Washington, on the eighteenth day of November, one thousand nine hundred and three, the original of which Convention, being in the English language, is word for word as follows:

#### ISTHMIAN CANAL CONVENTION.

The United States of America and the Republic of Panama being desirous to insure the construction of a ship canal across the Isthmus of Panama to connect the Atlantic and Pacific Oceans, and the Congress of the United States of America having passed an act approved June 28, 1902, in furtherance of that object, by which the President of the United States is authorized to acquire within a reasonable time the control of the necessary territory of the Republic of Colombia, and the sovereignty of such territory being actually vested in the Republic of Panama, the high contracting parties have resolved for that purpose to conclude a convention and have accordingly appointed as their plenipotentiaries,—

The President of the United States of America, John Hay, Secretary of State, and

The Government of the Republic of Panama, Philippe Bunau-Varilla, Envoy Extraordinary and Minister Plenipotentiary of the Republic of Panama, thereunto specially empowered by said government, who after communicating with each other their respective full powers, found to be in good and due form, have agreed upon and concluded the following articles:

#### ARTICLE I.

The United States guarantees and will maintain the independence of the Republic of Panama.

#### ARTICLE II.

The Republic of Panama grants to the United States in perpetuity the use, occupation and control of a zone of land and land under water for the construction, maintenance, operation, sanitation and protection of said canal of the width of ten miles extending to the distance of five miles on each side of the center line of the route of

the canal to be constructed; the said zone beginning in the Caribbean Sea three marine miles from mean low water mark and extending to and across the Isthmus of Panama into the Pacific Ocean to a distance of three marine miles from mean low water mark with the proviso that the cities of Panama and Colon and the harbors adjacent to said cities, which are included within the boundaries of the zone above described, shall not be included within this grant. The Republic of Panama further grants to the United States in perpetuity the use, occupation and control of any other lands and waters outside of the zone above described which may be necessary and convenient for the construction, maintenance, operation, sanitation and protection of the said Canal or of any auxiliary canals or other works necessary and convenient for the construction, maintenance, operation, sanitation and protection of said enterprise.

The Republic of Panama further grants in like manner to the United States in perpetuity all islands within the limits of the zone above described and in addition thereto the group of small islands in the Bay of Panama, named Perico, Naos, Culebra and Flamenco.

#### ARTICLE III.

The Republic of Panama grants to the United States all the rights, power and authority within the zone mentioned and described in Article II of this agreement and within the limits of all auxiliary lands and waters mentioned and described in said Article II which the United States would possess and exercise if it were the sovereign of the territory within which said lands and waters are located to the entire exclusion of the exercise by the Republic of Panama of any such sovereign rights, power or authority.

#### ARTICLE IV.

As rights subsidiary to the above grants the Republic of Panama grants in perpetuity to the United States the right to use the rivers, streams, lakes and other bodies of water within its limits for navigation, the supply of water or water-power or other purposes, so far as the use of said rivers, streams, lakes and bodies of water and the waters thereof may be necessary and convenient for the construction, maintenance, operation, sanitation and protection of the said Canal.

#### ARTICLE V.

The Republic of Panama grants to the United States in perpetuity a monopoly for the construction, maintenance and operation of any system of communication by means of canal or railroad across its territory between the Caribbean Sea and the Pacific Ocean.

#### ARTICLE VI.

The grants herein contained shall in no manner invalidate the titles or rights of private land holders or owners of private property in the said zone or in or to any of the lands or waters granted to the United States by the provisions of any Article of this treaty, nor shall they interfere with the rights of way over the public roads passing through the said zone or over any of the said lands or waters unless said rights of way or private rights shall conflict with rights herein granted to the United States in which case the rights of the United States shall be superior. All damages caused to the owners of private lands or private property of any kind by reason of the grants contained in this treaty or by reason of the operations of the United States, its agents or employees, or by reason of the construction, maintenance, operation, sanitation and protection of the said Canal or of the works of sanitation and protection herein provided for, shall be appraised and settled by a joint Commission appointed by the Governments of the United States and the Republic of Panama, whose decisions as to such damages shall be final and whose awards as to such damages shall be paid solely by the United States. No part of the work on said Canal or the Panama Railroad or on any auxiliary works relating thereto and authorized by the terms of this treaty shall be prevented, delayed or impeded by or pending such proceedings to ascertain such damages. The appraisal of said private lands and private property and the assessment of damages to them shall be based upon their value before the date of this convention.

#### ARTICLE VII.

The Republic of Panama grants to the United States within the limits of the cities of Panama and Colon and their adjacent harbors and within the territory adjacent thereto the right to acquire by purchase or by the exercise of the right of eminent domain, any lands, buildings, water rights or other properties necessary and convenient

for the construction, maintenance, operation and protection of the Canal and of any works of sanitation, such as the collection and disposition of sewage and the distribution of water in the said cities of Panama and Colon, which, in the discretion of the United States may be necessary and convenient for the construction, maintenance, operation, sanitation and protection of the said Canal and railroad. All such works of sanitation, collection and disposition of sewage and distribution of water in the cities of Panama and Colon shall be made at the expense of the United States, and the Government of the United States, its agents or nominees shall be authorized to impose and collect water rates and sewerage rates which shall be sufficient to provide for the payment of interest and the amortization of the principal of the cost of said works within a period of fifty years and upon the expiration of said term of fifty years the system of sewers and water works shall revert to and become the properties of the cities of Panama and Colon respectively, and the use of the water shall be free to the inhabitants of Panama and Colon, except to the extent that water rates may be necessary for the operation and maintenance of said system of sewers and water.

The Republic of Panama agrees that the cities of Panama and Colon shall comply in perpetuity with the sanitary ordinances whether of a preventive or curative character prescribed by the United States and in case the Government of Panama is unable or fails in its duty to enforce this compliance by the cities of Panama and Colon with the sanitary ordinances of the United States the Republic of Panama grants to the United States the right and authority to enforce the same.

The same right and authority are granted to the United States for the maintenance of public order in the cities of Panama and Colon and the territories and harbors adjacent thereto in case the Republic of Panama should not be, in the judgment of the United States, able to maintain such order.

#### ARTICLE VIII.

The Republic of Panama grants to the United States all rights which it now has or hereafter may acquire to the property of the New Panama Canal Company and the Panama Railroad Company as a result of the transfer of sovereignty from the Republic of Colombia to the Republic of Panama over the Isthmus of Panama and authorizes the New Panama Canal Company to sell and transfer to the United States its rights, privileges, properties and concessions as well as the Panama Railroad and all the shares or part of the shares of that company; but the public lands situated outside of the Zone described in Article II of this treaty now included in the concessions to both said enterprises and not required in the construction or operation of the Canal shall revert to the Republic of Panama except any property now owned by or in the possession of said companies within Panama or Colon or the ports or terminals thereof.

#### ARTICLE IX.

The United States agrees that the ports at either entrance of the Canal and the waters thereof, and the Republic of Panama agrees that the towns of Panama and Colon shall be free for all time so that there shall not be imposed or collected custom house tolls, tonnage, anchorage, light-house, wharf, pilot, or quarantine dues or any other charges or taxes of any kind upon any vessel using or passing through the Canal or belonging to or employed by the United States, directly or indirectly, in connection with the construction, maintenance, operation, sanitation and protection of the main Canal, or auxiliary works, or upon the cargo, officers, crew or passengers of any such vessels, except such tolls and charges as may be imposed by the United States for the use of the Canal and other works, and except tolls and charges imposed by the Republic of Panama upon merchandise destined to be introduced for the consumption of the rest of the Republic of Panama, and upon vessels touching at the ports of Colon and Panama and which do not cross the Canal.

The Government of the Republic of Panama shall have the right to establish in such ports and in the towns of Panama and Colon such houses and guards as it may deem necessary to collect duties on importations destined to other portions of Panama and to prevent contraband trade. The United States shall have the right to make use of the towns and harbors of Panama and Colon as places of anchorage, and for making repairs, for loading, unloading, depositing, or transshipping cargoes either in transit or destined for the service of the Canal and for other works pertaining to the Canal.

#### ARTICLE X.

The Republic of Panama agrees that there shall not be imposed any taxes, national, municipal, departmental, or of any other class, upon the Canal, the railways and auxiliary works, tugs and other vessels employed in the service of the Canal, store houses,

work shops, offices, quarters for laborers, factories of all kinds, warehouses, wharves, machinery, and other works, property, and effects appertaining to the Canal or railroad and auxiliary works, or their officers or employees, situated within the cities of Panama and Colon, and that there shall not be imposed contributions or charges of a personal character of any kind upon officers, employees, laborers, and other individuals in the service of the Canal and railroad and auxiliary works.

## ARTICLE XI.

The United States agrees that the official dispatches of the Government of the Republic of Panama shall be transmitted over any telegraph and telephone lines established for Canal purposes and used for public and private business at rates not higher than those required from officials in the service of the United States.

## ARTICLE XII.

The Government of the Republic of Panama shall permit the immigration and free access to the lands and workshops of the Canal and its auxiliary works of all employees and workmen of whatever nationality under contract to work upon or seeking employment upon or in any wise connected with the said Canal and its auxiliary works, with their respective families, and all such persons shall be free and exempt from the military service of the Republic of Panama.

## ARTICLE XIII.

The United States may import at any time into the said zone and auxiliary lands, free of customs duties, imposts, taxes, or other charges, and without any restrictions, any and all vessels, dredges, engines, cars, machinery, tools, explosives, materials, supplies, and other articles necessary and convenient in the construction, maintenance, operation, sanitation and protection of the Canal and auxiliary works, and all provisions, medicines, clothing, supplies and other things necessary and convenient for the officers, employees, workmen and laborers in the service and employ of the United States and for their families. If any such articles are disposed of for use outside of the zone and auxiliary lands granted to the United States and within the territory of the Republic, they shall be subject to the same import or other duties as like articles imported under the laws of the Republic of Panama.

## ARTICLE XIV.

As the price or compensation for the rights, powers and privileges granted in this convention by the Republic of Panama to the United States, the Government of the United States agrees to pay to the Republic of Panama the sum of ten million dollars (\$10,000,000) in gold coin of the United States on the exchange of the ratification of this convention and also an annual payment during the life of this convention of two hundred and fifty thousand dollars (\$250,000) in like gold coin, beginning nine years after the date aforesaid.

The provisions of this Article shall be in addition to all other benefits assured to the Republic of Panama under this convention.

But no delay or difference of opinion under this Article or any other provisions of this treaty shall affect or interrupt the full operation and effect of this convention in all other respects.

## ARTICLE XV.

The joint commission referred to in Article VI shall be established as follows:

The President of the United States shall nominate two persons and the President of the Republic of Panama shall nominate two persons and they shall proceed to a decision; but in case of disagreement of the Commission (by reason of their being equally divided in conclusion) an umpire shall be appointed by the two Governments who shall render the decision. In the event of the death, absence, or incapacity of a Commissioner or Umpire, or of his omitting, declining or ceasing to act, his place shall be filled by the appointment of another person in the manner above indicated. All decisions by a majority of the Commission or by the umpire shall be final.

## ARTICLE XVI.

The two Governments shall make adequate provision by future agreement for the pursuit, capture, imprisonment, detention and delivery within said zone and auxiliary

lands to the authorities of the Republic of Panama of persons charged with the commitment of crimes, felonies or misdemeanors without said zone and for the pursuit, capture, imprisonment, detention and delivery without said zone to the authorities of the United States of persons charged with the commitment of crimes, felonies and misdemeanors within said zone and auxiliary lands.

#### ARTICLE XVII.

The Republic of Panama grants to the United States the use of all the ports of the Republic open to commerce as places of refuge for any vessels employed in the Canal enterprise, and for all vessels passing or bound to pass through the Canal which may be in distress and be driven to seek refuge in said ports. Such vessels shall be exempt from anchorage and tonnage dues on the part of the Republic of Panama.

#### ARTICLE XVIII.

The Canal, when constructed, and the entrances thereto shall be neutral in perpetuity, and shall be opened upon the terms provided for by Section I of Article three of, and in conformity with all the stipulations of, the treaty entered into by the Governments of the United States and Great Britain on November 18, 1901.

#### ARTICLE XIX.

The Government of the Republic of Panama shall have the right to transport over the Canal its vessels and its troops and munitions of war in such vessels at all times without paying charges of any kind. The exemption is to be extended to the auxiliary railway for the transportation of persons in the service of the Republic of Panama, or of the police force charged with the preservation of public order outside of said zone, as well as to their baggage, munitions of war and supplies.

#### ARTICLE XX.

If by virtue of any existing treaty in relation to the territory of the Isthmus of Panama, whereof the obligations shall descend or be assumed by the Republic of Panama, there may be any privilege or concession in favor of the Government or the citizens or subjects of a third power relative to an interoceanic means of communication which in any of its terms may be incompatible with the terms of the present convention, the Republic of Panama agrees to cancel or modify such treaty in due form, for which purpose it shall give to the said third power the requisite notification within the term of four months from the date of the present convention, and in case the existing treaty contains no clause permitting its modifications or annulment, the Republic of Panama agrees to procure its modification or annulment in such form that there shall not exist any conflict with the stipulations of the present convention.

#### ARTICLE XXI.

The rights and privileges granted by the Republic of Panama to the United States in the preceding Articles are understood to be free of all anterior debts, liens, trusts, or liabilities, or concessions or privileges to other Governments, corporations, syndicates or individuals, and consequently, if there should arise any claims on account of the present concessions and privileges or otherwise, the claimants shall resort to the Government of the Republic of Panama and not to the United States for any indemnity or compromise which may be required.

#### ARTICLE XXII.

The Republic of Panama renounces and grants to the United States the participation to which it might be entitled in the future earnings of the Canal under Article XV of the concessionary contract with Lucien N. B. Wyse now owned by the New Panama Canal Company and any and all other rights or claims of a pecuniary nature arising under or relating to said concession, or arising under or relating to the concessions to the Panama Railroad Company or any extension or modification thereof; and it likewise renounces, confirms and grants to the United States, now and hereafter, all the rights and property reserved in the said concessions which otherwise would belong to Panama at or before the expiration of the terms of ninety-nine years of the concessions granted to or held by the above mentioned party and companies, and all right, title and interest which it now has or may hereafter have, in and to the lands, canal, works,

property and rights held by the said companies under said concessions or otherwise, and acquired or to be acquired by the United States from or through the New Panama Canal Company, including any property and rights which might or may in the future either by lapse of time, forfeiture or otherwise, revert to the Republic of Panama under any contracts or concessions, with said Wyse, the Universal Panama Canal Company, the Panama Railroad Company and the New Panama Canal Company.

The aforesaid rights and property shall be and are free and released from any present or reversionary interest or claims of Panama and the title of the United States thereto upon consummation of the contemplated purchase by the United States from the New Panama Canal Company, shall be absolute, so far as concerns the Republic of Panama, excepting always the rights of the Republic specifically secured under this treaty.

#### ARTICLE XXIII.

If it should become necessary at any time to employ armed forces for the safety or protection of the Canal, or of the ships that make use of the same, or the railways and auxiliary works, the United States shall have the right, at all times and in its discretion, to use its police and its land and naval forces or to establish fortifications for these purposes.

#### ARTICLE XXIV.

No change either in the Government or in the laws and treaties of the Republic of Panama shall, without the consent of the United States, affect any right of the United States under the present convention, or under any treaty stipulation between the two countries that now exists or may hereafter exist touching the subject matter of this convention.

If the Republic of Panama shall hereafter enter as a constituent into any other Government or into any union or confederation of states, so as to merge her sovereignty or independence in such Government, union or confederation, the rights of the United States under this convention shall not be in any respect lessened or impaired.

#### ARTICLE XXV.

For the better performance of the engagements of this convention and to the end of the efficient protection of the Canal and the preservation of its neutrality, the Government of the Republic of Panama will sell or lease to the United States lands adequate and necessary for naval or coaling stations on the Pacific Coast and on the western Caribbean Coast of the Republic at certain points to be agreed upon with the President of the United States.

#### ARTICLE XXVI.

This convention when signed by the Plenipotentiaries of the Contracting Parties shall be ratified by the respective Governments and the ratifications shall be exchanged at Washington at the earliest date possible.

In faith whereof the respective Plenipotentiaries have signed the present convention in duplicate and have hereunto affixed their respective seals.

Done at the City of Washington the 18th day of November in the year of our Lord nineteen hundred and three.

JOHN HAY [SEAL]  
P. BUNAU VARILLA [SEAL]

And whereas the said Convention has been duly ratified on both parts, and the ratifications of the two governments were exchanged in the City of Washington, on the twenty-sixth day of February, one thousand nine hundred and four;

Now, therefore, be it known that I, Theodore Roosevelt, President of the United States of America, have caused the said Convention to be made public, to the end that the same and every article and clause thereof, may be observed and fulfilled with good faith by the United States and the citizens thereof.

In testimony whereof, I have hereunto set my hand and caused the seal of the United States of America to be affixed.

Done at the City of Washington, this twenty-sixth day of February, in the year of our Lord one thousand nine hundred and four, and of the Independence of the United States the one hundred and twenty-eighth.

[SEAL.]

THEODORE ROOSEVELT.

By the President:

JOHN HAY,  
*Secretary of State.*

An Act To provide for the temporary government of the Canal Zone at Panama, the protection of the canal works, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the President is hereby authorized, upon the acquisition of the property of the New Panama Canal Company and the payment to the Republic of Panama of the ten millions of dollars provided by article fourteen of the treaty between the United States and the Republic of Panama, the ratifications of which were exchanged on the twenty-sixth day of February, nineteen hundred and four, to be paid to the latter Government, to take possession of and occupy on behalf of the United States the zone of land and land under water of the width of ten miles, extending to the distance of five miles on each side of the center line of the route of the canal to be constructed thereon, which said zone begins in the Caribbean Sea three marine miles from mean low-water mark and extends to and across the Isthmus of Panama into the Pacific Ocean to the distance of three marine miles from mean low-water mark, and also of all islands within said zone, and in addition thereto the group of islands in the Bay of Panama named Perico, Naos, Culebra, and Flamenco, and, from time to time, of any lands and waters outside of said zone which may be necessary and convenient for the construction, maintenance, operation, sanitation, and protection of the said canal, or of any auxiliary canals or other works necessary and convenient for the construction, maintenance, operation, sanitation, and protection of said enterprise, the use, occupation, and control whereof were granted to the United States by article two of said treaty. The said zone is hereinafter referred to as "the Canal Zone." The payment of the ten millions of dollars provided by article fourteen of said treaty shall be made in lieu of the indefinite appropriation made in the third section of the Act of June twenty-eighth, nineteen hundred and two, and is hereby appropriated for said purpose.

SEC. 2. That until the expiration of the Fifty-eighth Congress, unless provision for the temporary government of the Canal Zone be sooner made by Congress, all the military, civil, and judicial powers as well as the power to make all rules and regulations necessary for the government of the Canal Zone and all the rights, powers, and authority granted by the terms of said treaty to the United States shall be vested in such person or persons and shall be exercised in such manner as the President shall direct for the government of said Zone and maintaining and protecting the inhabitants thereof in the free enjoyment of their liberty, property, and religion.

Approved, April 28, 1904. [33 U. S. Stats., 429.]

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An Act Making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and six, and for other purposes.

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Hereafter the accounts for the Isthmian Canal Commission shall be audited by the Auditor for the War Department.

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Approved, February 3, 1905.

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An Act Fixing the status of merchandise coming into the United States from the Canal Zone, Isthmus of Panama.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That all laws affecting imports of articles, goods, wares, and merchandise and entry of persons into the United States from foreign countries shall apply to articles, goods, wares, and merchandise and persons coming from the Canal Zone, Isthmus of Panama, and seeking entry into any State or Territory of the United States or the District of Columbia.

Approved, March 2, 1905. [33 U. S. Stats., 843.]

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An Act Supplemental to an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two, and making appropriation for Isthmian Canal construction, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the two per cent bonds of the United States authorized by section eight of the Act entitled "An Act to provide for the construction of a canal

connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eight, nineteen hundred and two, shall have all the rights and privileges accorded by law to other two per cent bonds of the United States, and every national banking association having on deposit, as provided by law, such bonds issued under the provisions of said section eight of said Act approved June twenty-eight, nineteen hundred and two, to secure its circulating notes, shall pay to the Treasurer of the United States, in the months of January and July, a tax of one-fourth of one per cent each half year upon the average amount of such of its notes in circulation as are based upon the deposit of said two per cent bonds; and such tax shall be in lieu of existing taxes on its notes in circulation imposed by section fifty-two hundred and fourteen of the Revised Statutes.

SEC. 2. That there is hereby appropriated out of any money in the Treasury not otherwise appropriated, the sum of eleven million dollars to continue the construction of the Isthmian Canal, to be expended under the direction of the President in accordance with the said Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans, approved June twenty-eighth, nineteen hundred and two, and for each and every purpose connected with the same, the said sum to continue available until expended: *Provided*, That all expenditures from the appropriation herein made shall be reimbursed to the Treasury of the United States out of the proceeds of the sale of bonds authorized in section eight of the said Act approved June twenty-eighth, nineteen hundred and two.

SEC. 3. That the President shall annually, and at such other periods as may be provided, either by law or by his order, require full and complete reports to be made to him by the persons appointed or employed by him in charge of the government of the Canal Zone, the construction of the Isthmian Canal, and the operation of the Panama Railroad, including an itemized account of all moneys received and expended, which said reports shall be by the President transmitted to Congress. The President shall annually cause to be made, by the persons appointed and employed by him in charge of the government of said Canal Zone and the construction of said canal, estimates of expenditures and appropriations, in detail as far as practicable, which estimates shall cover all annual salaries paid to persons employed on said work, excepting laborers and skilled laborers, and shall be submitted to Congress in the manner provided in section five of the Act entitled "An Act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and two, and for other purposes." And no money shall be expended for any of the purposes of constructing and maintaining said Isthmian Canal, or for any expenses incident thereto, except in accordance with appropriations made by Congress.

Approved, December 21, 1905.

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An Act Making appropriations to supply urgent deficiencies in the appropriations for the fiscal year ending June thirtieth, nineteen hundred and six, and for prior years, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply deficiencies in the appropriations for the fiscal year nineteen hundred and six, and for prior years, and for other objects hereinafter stated, namely:

\* \* \* \* \*

#### THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under direction of the President in accordance with an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two, as follows:

For miscellaneous material purchases in the United States, one million dollars;

For miscellaneous material purchases on the Isthmus and miscellaneous expenditures, consisting of hotel and hospital and other supplies, transportation of labor from West Indies, four hundred thousand dollars;

For amounts to pay the Panama Railroad Company for material and services, including construction of second main track, two hundred thousand dollars;

For Isthmus pay rolls, two million one hundred thousand dollars;

For salaries, incidental expenses, rents, cable and telegraph service in the United States, covering Washington office, including Commissioners, offices of assistant pur-



chasing agents at New Orleans, New York, and Tacoma, seventy-five thousand dollars: *Provided*, That no part of the money herein appropriated shall be paid to any Commissioner as compensation in addition to his salary as Commissioner;

For new equipment purchases, one million five hundred and sixty-five thousand seven hundred and eighty-six dollars; in all, five million three hundred and forty thousand seven hundred and eighty-six dollars, which shall continue available until expended: *Provided*, That all expenditures from the appropriation herein and hereinafter made for the Isthmian Canal shall be paid from, or reimbursed to the Treasury of the United States out of, the proceeds of the sale of bonds authorized in section eight of the said Act approved June twenty-eighth, nineteen hundred and two.

To be used as an advance to the Panama Railroad Company to pay for the reequipping of that company, six hundred and fifty thousand dollars.

The provisions of the Act entitled "An Act relating to the limitations of the hours of daily service of laborers and mechanics employed upon the public works of the United States and of the District of Columbia," approved August first, eighteen hundred and ninety-two, shall not apply to alien laborers employed in the construction of the Isthmian Canal within the Canal Zone.

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Approved, February 27, 1906.

Joint Resolution Providing for the purchase of material and equipment for use in the construction of the Panama Canal.

*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled*, That purchases of material and equipment for use in the construction of the Panama Canal shall be restricted to articles of domestic production and manufacture, from the lowest responsible bidder, unless the President shall, in any case, deem the bids or tenders therefor to be extortionate or unreasonable.

Approved, June 25, 1906.

An Act For the acknowledgment of deeds and other instruments in Guam, Samoa, and the Canal Zone to affect lands in the District of Columbia and other Territories.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That deeds and other instruments affecting land situate in the District of Columbia or any Territory of the United States may be acknowledged in the islands of Guam and Samoa or in the Canal Zone before any notary public or judge, appointed therein by proper authority, or by any officer therein who has ex officio the powers of a notary public: *Provided*, That the certificate by such notary in Guam, Samoa, or the Canal Zone, as the case may be, shall be accompanied by the certificate of the governor or acting governor of such place to the effect that the notary taking said acknowledgment was in fact the officer he purported to be; and any deeds or other instruments affecting lands so situate, so acknowledged since the first day of January, nineteen hundred and five, and accompanied by such certificate shall have the same effect as such deeds or other instruments hereafter so acknowledged and certified.

Approved, June 28, 1906.

An Act To provide for the construction of a lock canal connecting the waters of the Atlantic and Pacific oceans, and the method of construction.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That a lock canal be constructed across the Isthmus of Panama connecting the waters of the Atlantic and Pacific oceans, of the general type proposed by the minority of the Board of Consulting Engineers, created by order of the President dated January twenty-fourth, nineteen hundred and five, in pursuance of an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two.

Approved, June 29, 1906.

An Act Making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and seven, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, nineteen hundred and seven, namely:

\* \* \* \* \*

THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President in accordance with an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two: *Provided*, That no part of the sums herein appropriated shall be used for the construction of a canal of the so-called sea-level type, as follows:

For salaries of members, officers, and employees of the Isthmian Canal Commission, including inspectors of material, examiners, assistant purchasing and shipping agents, and all other employees in the United States, two hundred and fifty-one thousand and sixty-three dollars and thirty-three cents;

For incidental expenses, including rents, cable and telegraph service, supplies, stationery and printing, and actual necessary traveling expenses in the United States (including rent of the Panama Canal building in the District of Columbia, twelve thousand dollars, and text-books and books of reference, one thousand dollars), one hundred and seventeen thousand one hundred and seventy-nine dollars and thirty-six cents;

For pay of officers and employees other than skilled and unskilled labor on the Isthmus, for the construction and engineering and administration departments, two million six hundred and fifty thousand five hundred and twelve dollars;

For skilled and unskilled labor on the Isthmus, for the departments of construction and engineering and administration, nine million fifty thousand six hundred and sixty-one dollars;

For purchase and delivery of material, supplies, and equipment for the construction and engineering and administration departments on the Isthmus of Panama, nine million thirty-two thousand eight hundred and fourteen dollars and twenty-four cents;

To continue the reequipment of the Panama Railroad, to be disbursed directly under the Isthmian Canal Commission, one million dollars; no part of said sum shall have been so expended until the obligation of the Panama Railroad Company for the full amount thereof and drawing four per cent interest payable to the United States shall have been delivered to the Secretary of the Treasury of the United States and by him accepted.

For miscellaneous expenditures, cable and telegraph service, stationery and printing, and traveling and incidental expenses on the Isthmus for the construction and engineering and administration departments, four hundred and thirty-four thousand five hundred and fifty dollars;

For pay of officers and employees other than skilled and unskilled labor in the service of the government of the Canal Zone, six hundred thousand dollars;

For skilled and unskilled labor in the service of the government of the Canal Zone, fifty thousand dollars;

For material, supplies, equipment, new buildings, and contingent expenses for account of the government of the Canal Zone, three hundred and eighteen thousand two hundred dollars;

For pay of officers and employees other than skilled and unskilled labor engaged in the health and sanitation department on the Isthmus, five hundred and fifty thousand dollars;

For skilled and unskilled labor engaged in the health and sanitation department on the Isthmus of Panama, five hundred and seventy-nine thousand and sixty-eight dollars;

For material, supplies, equipment, new buildings, and contingent expenses of the health and sanitation department on the Isthmus, eight hundred and twenty-two thousand three hundred and sixty-seven dollars and fifteen cents;

In all, twenty-five million four hundred and fifty-six thousand four hundred and fifteen dollars and eight cents: *Provided*, That all expenditures from the appropriation herein made for the Isthmian Canal shall be paid from, or reimbursed to the Treasury of the United States out of, the proceeds of the sale of bonds authorized in section eight of the said Act approved June twenty-eighth, nineteen hundred and two.

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Approved, June 30, 1906.

10307°—11—36

An Act Making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, nineteen hundred and six, and for prior years, and for other purposes.

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SEC. 4. The provisions of an Act entitled "An Act relating to the limitations of the hours of daily service of laborers and mechanics employed upon the public works of the United States and of the District of Columbia," approved August first, eighteen hundred and ninety-two, and of an Act entitled "An Act making appropriations to supply urgent deficiencies in the appropriations for the fiscal year ending June thirtieth, nineteen hundred and six, and for prior years, and for other purposes," approved February twenty-seventh, nineteen hundred and six, shall not apply to unskilled alien laborers and to the foremen and superintendents of such laborers, employed in the construction of the Isthmian Canal within the Canal Zone.

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Approved, June 30, 1906.

[Extract from the act of Congress entitled "An Act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and eight, and for other purposes."]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, nineteen hundred and eight, namely:*

\* \* \* \* \*

#### THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President in accordance with an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two.

For salaries of members, officers, and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States, one hundred and eighty-four thousand dollars;

For incidental expenses, including rents, cable and telegraph service, supplies, stationery and printing, and actual necessary traveling expenses in the United States (including rent of the Panama Canal Building in the District of Columbia, twelve thousand dollars, and text-books and books of reference, one thousand dollars), sixty-nine thousand dollars;

For pay of officers and employees on the Isthmus, other than skilled and unskilled labor, including civil engineers, superintendents, instrumentmen, transitmen, levelmen, rodmen, draughtsmen, timekeepers, mechanical and electrical engineers, supervisors, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, watchmen, wagon masters, stewards, hospital dispensers, internes, nurses, and attendants, including those necessarily and temporarily detailed for duty away from the Isthmus, for the departments of construction and engineering, auditing, disbursing, and labor, quarters and subsistence, two million seven hundred and seventy-two thousand dollars;

For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths and other artisans, and their helpers, janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, accounting, disbursements, and labor, quarters and subsistence, seven million nine hundred and ninety thousand dollars;

For purchase and delivery of material, supplies, and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the Commission deems necessary to best promote the construction of the Isthmian Canal, for the departments of construction and engineering, auditing, disbursing, and labor, quarters and subsistence, nine million forty-six thousand dollars;

To continue the equipment and construction of the Panama Railroad, to be disbursed directly under the Isthmian Canal Commission, one million three hundred and eighty-five thousand dollars; no part of said sum shall be expended until the obligation of the Panama Railroad Company for the full amount thereof and drawing four per centum interest payable to the United States shall have been delivered to the Secretary of the Treasury of the United States and by him accepted;

To pay the outstanding four and one-half per centum first-mortgage bonds of the Panama Railway Company October first, nineteen hundred and seven, two million two hundred and ninety-eight thousand three hundred and sixty-seven dollars and fifty cents, to be reimbursed to the Treasury of the United States, as provided for appropriations herein made for the Isthmian Canal;

For miscellaneous expenditures, cable and telegraph service, stationery and printing, and traveling and incidental expenses on the Isthmus, for the departments of construction and engineering, accounting, disbursing, and labor, quarters and subsistence, five hundred and fifty-eight thousand dollars;

For pay of officers and employees other than skilled and unskilled labor in the service of the government of the Canal Zone, four hundred and eighty-six thousand dollars;

For skilled and unskilled labor in the service of the government of the Canal Zone, fifty thousand dollars;

For material, supplies, equipment, new buildings, and contingent expenses for account of the government of the Canal Zone, two hundred and eighty-nine thousand dollars;

For pay of officers and employees other than skilled and unskilled labor engaged in the sanitation department on the Isthmus, seven hundred and sixty-six thousand dollars;

For skilled and unskilled labor engaged in the sanitation department on the Isthmus of Panama, four hundred and sixty-eight thousand dollars;

For material, supplies, equipment, new buildings, and contingent expenses of the sanitation department on the Isthmus, eight hundred thousand dollars;

In all, twenty-seven million one hundred and sixty-one thousand three hundred and sixty-seven dollars and fifty cents, the same to be available until expended: *Provided*, That all expenditures from the appropriation herein made for the Isthmian Canal shall be paid from, or reimbursed to the Treasury of the United States out of, the proceeds of the sale of bonds authorized in section eight of the said Act approved June twenty-eighth, nineteen hundred and two.

Ten per centum of the foregoing amounts shall be available interchangeably for expenditure on objects named; but not more than ten per centum shall be added to any one item of the appropriation.

SEC. 2. All funds collected by the government of the Canal Zone from rentals of public lands and buildings in the Canal Zone and the cities of Panama and Colon, and from the Zone postal service, and from court fees and fines, and collected or raised by taxation in whatsoever form under the laws of the government of the Canal Zone, are hereby appropriated until and including June thirtieth, nineteen hundred and eight, as follows: The revenues derived from the postal service to the maintenance of that service; the remaining revenues, after setting aside a miscellaneous and contingent fund of ten thousand dollars, to the maintenance of the public school system in the Zone, and to public improvements within the Zone. A detailed and classified statement of all receipts and expenditures without the duplication of items under this paragraph shall be submitted to Congress after the close of the fiscal year nineteen hundred and eight.

SEC. 3. Any unexpended balance of the appropriation for the construction of the Isthmian Canal contained in the Act of June thirtieth, nineteen hundred and six, is hereby reappropriated to meet deficiencies heretofore incurred, and to further remain available until expended.

SEC. 4. That one hundred thousand dollars of the said appropriation for the fiscal year nineteen hundred and seven, "For skilled and unskilled labor on the Isthmus for the departments of construction and engineering and administration," shall be transferred to the appropriation "For skilled and unskilled labor engaged in the health and sanitation department on the Isthmus of Panama" of the same Act; that three hundred thousand dollars of the said appropriation "For skilled and unskilled labor on the Isthmus for the departments of construction and engineering and administration," shall be transferred to the appropriation "For miscellaneous expenditures" for the same departments, of the same Act; that fifty thousand dollars of the appropriation "For pay of officers and employees other than skilled and unskilled labor on the Isthmus, for the construction and engineering and administration departments," shall be transferred to the appropriation "For pay of officers and employees other than skilled and unskilled labor engaged in the health and sanitation department on the Isthmus," of the same Act; and that any unexpended balance of the appropriation in the said bill "To continue the reequipment of the Panama Railroad" may be paid to the Panama Railroad Company to reimburse that company for direct expenditures for equipment and construction: *Provided*, That all expenses so reimbursed shall first be approved by the Commission and then audited in all respects as if disbursed directly under the Commission.

SEC. 5. All sums appropriated hereunder and under the Act of June thirtieth, nineteen hundred and six, for the use upon the Isthmus of the several departments shall be available for the payment of the direct obligations of the Canal Commission, or of the Commission's obligations under any contract or contracts that have been or may hereafter be entered into for the construction of the Isthmian Canal.

SEC. 6. Nothing contained in section five of the Act of June twenty-eighth, nineteen hundred and two, entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," shall prevent the President from entering into such contract or contracts as may be deemed expedient by him for the completion of the construction of the Panama Canal.

SEC. 7. The appropriations for the pay of officers and employees of the several departments on the Isthmus under the Act of June thirtieth, nineteen hundred and six, shall apply to the pay of such officers and employees when necessarily temporarily detailed upon duty away from the Isthmus.

SEC. 8. All amounts due from employees, whether to the Commission, Panama Railroad Company, or contractor, for transportation, board, supplies, or for any other service, are hereby authorized to be deducted from the compensation otherwise payable to the said employees, and to be paid to the authorized parties or to be credited to the appropriation out of which the transportation, board, supplies, or other service was originally paid.

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Approved, March 4, 1907.

[Extract from the Act of Congress entitled "An Act Making appropriations to supply urgent deficiencies in the appropriations for the fiscal year ending June thirtieth, nineteen hundred and eight, and for prior years, and for other purposes."]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply deficiencies in the appropriations for the fiscal year nineteen hundred and eight, and for prior years, and for other objects hereinafter stated, namely:

#### THE ISTHMIAN CANAL.

For salaries of members, officers, and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States, eighteen thousand six hundred dollars.

For pay of officers and employees on the Isthmus other than skilled and unskilled labor, including civil engineers, superintendents, instrument men, transitmen, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, supervisors, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, watchmen, wagon masters, stewards, hospital dispensers, internes, nurses, and attendants, including those necessarily and temporarily detailed for duty away from the Isthmus, for the departments of construction and engineering, auditing, disbursing, and labor, quarters and subsistence, two hundred and ten thousand and seven hundred dollars.

For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths, and other artisans, and their helpers, janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, accounting, disbursements, and labor, quarters and subsistence, five million five hundred and thirty-six thousand three hundred dollars.

For purchase and delivery of material, supplies, and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the Commission deems necessary to best promote the construction of the Isthmian Canal, for the departments of construction and engineering, auditing, disbursing, and labor, quarters and subsistence, six million and eighty-five thousand seven hundred dollars.

For miscellaneous expenditures, cable and telegraph service, stationery and printing, and traveling and incidental expenses on the Isthmus, for the departments of construction and engineering, accounting, disbursing, and labor, quarters and subsistence, one hundred and fifty-seven thousand seven hundred dollars;

For skilled and unskilled labor engaged in the sanitation department on the Isthmus of Panama, one hundred and sixty-nine thousand nine hundred dollars;

Appropriations made for the construction of the Isthmian Canal in the Sundry Civil Appropriation Act, approved March fourth, nineteen hundred and seven, and in this Act shall continue available until expended.

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Approved, February 15, 1908.

*An Act Relating to the liability of common carriers by railroad to their employees in certain cases.*

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That every common carrier by railroad while engaging in commerce between any of the several States or Territories, or between any of the States and Territories, or between the District of Columbia and any of the States or Territories, or between the District of Columbia or any of the States or Territories and any foreign nation or nations, shall be liable in damages to any person suffering injury while he is employed by such carrier in such commerce, or, in case of the death of such employee, to his or her personal representative, for the benefit of the surviving widow or husband and children of such employee; and, if none, then of such employee's parents; and, if none, then of the next of kin dependent upon such employee, for such injury or death resulting in whole or in part from the negligence of any of the officers, agents, or employees of such carrier, or by reason of any defect or insufficiency, due to its negligence, in its cars, engines, appliances, machinery, track, roadbed, works, boats, wharves, or other equipment.

SEC. 2. That every common carrier by railroad in the Territories, the District of Columbia, the Panama Canal Zone, or other possessions of the United States shall be liable in damages to any person suffering injury while he is employed by such carrier in any of said jurisdictions, or, in case of the death of such employee, to his or her personal representative, for the benefit of the surviving widow or husband and children of such employee; and, if none, then of such employee's parents; and, if none, then of the next of kin dependent upon such employee, for such injury or death resulting in whole or in part from the negligence of any of the officers, agents, or employees of such carrier, or by reason of any defect or insufficiency, due to its negligence, in its cars, engines, appliances, machinery, track, roadbed, works, boats, wharves, or other equipment.

SEC. 3. That in all actions hereafter brought against any such common carrier by railroad under or by virtue of any of the provisions of this Act to recover damages for personal injuries to an employee, or where such injuries have resulted in his death, the fact that the employee may have been guilty of contributory negligence shall not bar a recovery, but the damages shall be diminished by the jury in proportion to the amount of negligence attributable to such employee: *Provided*, That no such employee who may be injured or killed shall be held to have been guilty of contributory negligence in any case where the violation by such common carrier of any statute enacted for the safety of employees contributed to the injury or death of such employee.

SEC. 4. That in any action brought against any common carrier under or by virtue of any of the provisions of this Act to recover damages for injuries to, or the death of, any of its employees, such employee shall not be held to have assumed the risks of his employment in any case where the violation by such common carrier of any statute enacted for the safety of employees contributed to the injury or death of such employee.

SEC. 5. That any contract, rule, regulation, or device whatsoever, the purpose or intent of which shall be to enable any common carrier to exempt itself from any liability created by this Act, shall to that extent be void: *Provided*, That in any action brought against any such common carrier under or by virtue of any of the provisions of this Act, such common carrier may set off therein any sum it has contributed or paid to any insurance, relief benefit, or indemnity that may have been paid to the injured employee or the person entitled thereto on account of the injury or death for which said action was brought.

SEC. 6. That no action shall be maintained under this Act unless commenced within two years from the day the cause of action accrued.

SEC. 7. That the term "common carrier" as used in this Act shall include the receiver or receivers or other persons or corporations charged with the duty of the management and operation of the business of a common carrier.

SEC. 8. That nothing in this Act shall be held to limit the duty or liability of common carriers or to impair the rights of their employees under any other Act or Acts of Congress, or to affect the prosecution of any pending proceeding or right of action under the Act of Congress entitled "An Act relating to liability of common carriers in the District of Columbia and Territories, and to common carriers engaged in commerce between the States and between the States and foreign nations to their employees," approved June eleventh, nineteen hundred and six.

Approved, April 22, 1908.

[Extract from the Act of Congress entitled "An Act Making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and nine, and for other purposes."]

*Be it enacted by the Senate and House of Representatives of the United States in Congress assembled,* That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, nineteen hundred and nine, namely:

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#### THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President in accordance with an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two:

First. For salaries of officers and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States, one hundred and forty-nine thousand dollars;

Second. For incidental expenses, including rents, cable and telegraph service, supplies, stationery and printing, and actual necessary traveling expenses in the United States (including rent of the Panama Canal building in the District of Columbia, seven thousand five hundred dollars, and text-books and books of reference, one thousand dollars, and additional compensation to the Auditor for the War Department for extra services in auditing accounts of the Isthmian Canal, one thousand dollars), twenty-seven thousand dollars, and the unexpended balances of appropriations for these objects available June thirtieth, nineteen hundred and eight;

Third. For pay of members of the Commission and officers and employees on the Isthmus other than skilled and unskilled labor, including civil engineers, superintendents, instrumentmen, transitmen, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, supervisors, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, watchmen, wagon masters, stewards, hospital dispensers, internes, nurses, and attendants, including those necessarily and temporarily detailed for duty away from the Isthmus, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence, and expenses incident to conducting hearings and examining estimates for appropriations on the Isthmus, three million four hundred thousand dollars;

Fourth. For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths, and other artisans, and their helpers, janitors, sailors, cooks, waiters, and dairy-men, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence, eight million four hundred thousand dollars;

Fifth. For purchase and delivery of material, supplies, and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the Commission deems necessary to best promote the construction of the Isthmian canal, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence, and to enable the Secretary of War to purchase for the Panama Railroad Company two steamships of American register each to be of not less than nine thousand gross registered tonnage and at a cost of not to exceed one million five hundred and fifty thousand dollars, said ships to be controlled and operated by said Panama Railroad Company in like manner as other ships of said Company including the transportation of supplies, equipment and material for use in the construction of the Panama Canal and the transportation of officers and employees of the Panama Canal Commission: *Provided*, That when said ships are no longer required for use as aforesaid in the transportation of supplies, equipment and material for the construction of the Panama Canal the same shall be transferred to the Secretary of the Navy for use as colliers or other auxiliary vessels belonging to the Navy, twelve million eight hundred thousand dollars;

Sixth. To continue the equipment and construction of the Panama Railroad, to be disbursed directly under the Isthmian Canal Commission, one million one hundred thousand dollars; no part of said sum shall be expended until the obligation of the Panama Railroad Company for the full amount thereof and drawing four per centum interest payable to the United States shall have been delivered to the Secretary of the Treasury of the United States and by him accepted;

Seventh. For miscellaneous expenditures, cable and telegraph service, stationery and printing, and traveling and incidental expenses on the Isthmus, for the depart-

ments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence, four hundred thousand dollars;

Eighth. For pay of officers and employees other than skilled and unskilled labor in the service of the government of the Canal Zone, two hundred and twenty-five thousand dollars and the unexpended balances of appropriations for these objects available June thirtieth, nineteen hundred and eight;

Ninth. For skilled and unskilled labor in the service of the government of the Canal Zone, sixteen thousand dollars and the unexpended balances of appropriations for these objects June thirtieth, nineteen hundred and eight;

Tenth. For material, supplies, equipment, new buildings, and contingent expenses for account of the government of the Canal Zone, the unexpended balances of appropriations for these objects June thirtieth, nineteen hundred and eight;

Eleventh. For pay of officers and employees other than skilled and unskilled labor engaged in the sanitation department on the Isthmus, seven hundred thousand dollars and the unexpended balances of appropriations for these objects June thirtieth, nineteen hundred and eight;

Twelfth. For skilled and unskilled labor engaged in the sanitation department on the Isthmus of Panama, five hundred thousand dollars;

Thirteenth. For material, supplies, equipment, new buildings, and contingent expenses of the sanitation department on the Isthmus, three hundred and seventy-five thousand dollars, and the unexpended balances of appropriations for these objects June thirtieth, nineteen hundred and eight;

Fourteenth. For the construction of the new Panama Railroad to be disbursed directly under the Isthmian Canal Commission, one million and eighty-five thousand dollars;

In all, twenty-nine million one hundred and seventy-seven thousand dollars, the same to be available until expended: *Provided*, That all expenditures from the appropriation herein and hereinafter made for the Isthmian Canal shall be paid from, or reimbursed to the Treasury of the United States out of, the proceeds of the sale of the bonds authorized in section eight of the Act approved June twenty-eighth, nineteen hundred and two.

To pay Pembroke B. Banton, of Waterloo, Iowa, to compensate him for injuries received while in the employment of the Government on the Isthmian Canal, ten thousand dollars.

Ten per centum of the foregoing amounts shall be available interchangeably for expenditure on objects named; but not more than ten per centum shall be added to any one item of the appropriation: *Provided, however*, That any surplus in the appropriations for any of the above classified heads may be used for expenditure under any of the classified appropriations for the department of construction and engineering.

SEC. 2. The foregoing appropriations shall be available to reimburse the Panama Railroad Company for marine losses, or for losses due to destruction of or damage to its plant, equipment, or commissary supplies by fire: *Provided, however*, That upon this appropriation becoming effective the Panama Railroad Company shall cease to carry insurance against loss from causes covered by this appropriation.

SEC. 3. All funds hereafter collected by the government of the Canal Zone from rentals of public lands and buildings in the Canal Zone and the cities of Panama and Colon, and from the Zone postal service, and from court fees, and collected or raised by taxation in whatever form under the laws of the government of the Canal Zone, are hereby appropriated until and including June thirtieth, nineteen hundred and nine, as follows: The revenues derived from the postal service to the maintenance of that service; the remaining revenues, after setting aside a miscellaneous and contingent fund of ten thousand dollars, to the maintenance of the public school system in the Zone; to the construction and maintenance of public improvements within the Zone; to the maintenance of the administrative districts, including payment of salaries and wages incident thereto; to the maintenance of Canal Zone charity patients in the hospitals of the Isthmian Canal Commission, and to the maintenance of administrative district prisoners. A detailed and classified statement of all receipts and expenditures without the duplication of items under this paragraph shall be submitted to Congress after the close of the fiscal year nineteen hundred and nine.

SEC. 4. All sums appropriated hereunder or that may hereafter be appropriated for the construction of the Isthmian Canal shall be available for the payment of the direct obligations of the Canal Commission, or of the Commission's obligations under any contract or contracts that may hereafter be entered into for the construction of the Isthmian Canal.

SEC. 5. All funds that hereafter may be derived from customs duties collected upon property of the United States imported from the Canal Zone are hereby reappropriated for the construction of the Isthmian Canal and may be expended under any of the classified appropriations for the department of construction and engineering.



SEC. 6. All funds realized during the fiscal year nineteen hundred and nine by the Isthmian Canal Commission from the performance of services by the Commission, or from the sale of materials and supplies upon the Isthmus under the custody and control of the Commission, are hereby reappropriated for expenditure under any of the foregoing classified appropriations for the department of construction and engineering, and a full and separate report in detail of all transactions hereunder shall be made to Congress.

SEC. 7. The officers of the Isthmian Canal Commission are relieved from liability to account for eleven thousand two hundred and five dollars and fifty-three cents, for materials and supplies furnished to the sufferers by the Jamaican earthquake of January fourteenth, nineteen hundred and seven.

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Approved, May 27, 1908.

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An Act Granting to certain employees of the United States the right to receive from it compensation for injuries sustained in the course of their employment.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That when, on or after August first, nineteen hundred and eight, any person employed by the United States as an artisan or laborer in any of its manufacturing establishments, arsenals, or navy-yards, or in the construction of river and harbor or fortification work or in hazardous employment on construction work in the reclamation of arid lands or the management and control of the same, or in hazardous employment under the Isthmian Canal Commission, is injured in the course of such employment, such employee shall be entitled to receive for one year thereafter, unless such employee, in the opinion of the Secretary of Commerce and Labor, be sooner able to resume work, the same pay as if he continued to be employed, such payment to be made under such regulations as the Secretary of Commerce and Labor may prescribe: *Provided,* That no compensation shall be paid under this Act where the injury is due to the negligence or misconduct of the employee injured, nor unless said injury shall continue for more than fifteen days. All questions of negligence or misconduct shall be determined by the Secretary of Commerce and Labor.

SEC. 2. That if any artisan or laborer so employed shall die during the said year by reason of such injury received in the course of such employment, leaving a widow, or a child or children under sixteen years of age, or a dependent parent, such widow and child or children and dependent parent shall be entitled to receive, in such portions and under such regulations as the Secretary of Commerce and Labor may prescribe, the same amount, for the remainder of the said year, that said artisan or laborer would be entitled to receive as pay if such employee were alive and continued to be employed: *Provided,* That if the widow shall die at any time during the said year her portion of said amount shall be added to the amount to be paid to the remaining beneficiaries under the provisions of this section, if there be any.

SEC. 3. That whenever an accident occurs to any employee embraced within the terms of the first section of this Act, and which results in death or a probable incapacity for work, it shall be the duty of the official superior of such employee to at once report such accident and the injury resulting therefrom to the head of his Bureau or independent office, and his report shall be immediately communicated through regular official channels to the Secretary of Commerce and Labor. Such report shall state, first, the time, cause, and nature of the accident and injury and the probable duration of the injury resulting therefrom; second, whether the accident arose out of or in the course of the injured person's employment; third, whether the accident was due to negligence or misconduct on the part of the employee injured; fourth, any other matters required by such rules and regulations as the Secretary of Commerce and Labor may prescribe. The head of each Department or independent office shall have power, however, to charge a special official with the duty of making such reports.

SEC. 4. That in the case of any accident which shall result in death, the persons entitled to compensation under this Act or their legal representative shall, within ninety days after such death, file with the Secretary of Commerce and Labor an affidavit setting forth their relationship to the deceased and the ground of their claim for compensation under the provisions of this Act. This shall be accompanied by the certificate of the attending physician setting forth the fact and cause of death, or the nonproduction of the certificate shall be satisfactorily accounted for. In the case of incapacity for work lasting more than fifteen days, the injured party desiring to take the benefit of this Act shall, within a reasonable period after the expiration of such time, file with his official superior, to be forwarded through regular official channels to the Secretary of Commerce and Labor, an affidavit setting forth the grounds of his

claim for compensation, to be accompanied by a certificate of the attending physician as to the cause and nature of the injury and probable duration of the incapacity, or the nonproduction of the certificate shall be satisfactorily accounted for. If the Secretary of Commerce and Labor shall find from the report and affidavit or other evidence produced by the claimant or his or her legal representatives, or from such additional investigation as the Secretary of Commerce and Labor may direct, that a claim for compensation is established under this Act, the compensation to be paid shall be determined as provided under this Act and approved for payment by the Secretary of Commerce and Labor.

SEC. 5. That the employee shall, whenever and as often as required by the Secretary of Commerce and Labor, at least once in six months, submit to medical examination, to be provided and paid for under the direction of the Secretary, and if such employee refuses to submit to or obstructs such examination, his or her right to compensation shall be lost for the period covered by the continuance of such refusal or obstruction.

SEC. 6. That payments under this Act are only to be made to the beneficiaries or their legal representatives other than assignees, and shall not be subject to the claims of creditors.

SEC. 7. That the United States shall not exempt itself from liability under this Act by any contract, agreement, rule, or regulation, and any such contract, agreement, rule, or regulation shall be pro tanto void.

SEC. 8. That all Acts or parts of Acts in conflict herewith or providing a different scale of compensation or otherwise regulating its payment are hereby repealed.

Approved, May 30, 1908.

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*An Act Relating to injured employees on the Isthmian Canal.*

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That nothing contained in the Act approved May thirtieth, nineteen hundred and eight, entitled "An Act granting to certain employees of the United States the right to receive from it compensation for injuries sustained in the course of their employment," shall prevent the Isthmian Canal Commission, under rules to be fixed by the commission, from granting to its injured employees, whether engaged in a hazardous employment or otherwise, leave of absence with pay for time necessarily lost as a result of injuries received in the course of employment, not exceeding in the aggregate thirty days per annum: *Provided, however,* That compensation paid to such injured employees under such regulations shall be deducted from any compensation which such employees may be entitled to receive under the terms of the said Act.

Approved, February 24, 1909.

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*An Act Relating to the use, control, and ownership of lands in the Canal Zone, Isthmus of Panama.*

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the President is hereby authorized to grant leases of the public lands in the Canal Zone, Isthmus of Panama, for such period, not exceeding twenty-five years, and upon such terms and conditions as he may deem advisable. No lease, however, shall be granted for a tract of land in excess of fifty hectares, nor to any person who shall not have first established, by affidavit and by such other proof as may be required, that such person is the head of a family or over the age of twenty-one years, and that the application for a lease is made in good faith for the purposes of actual settlement and cultivation, and not for the benefit of any other person whatsoever, and that such person will faithfully comply with all the requirements of law as to settlement, residence, and cultivation. In granting such leases preference shall be accorded to actual occupants of lands in good faith.

SEC. 2. That no portion of the lands of the United States within the Canal Zone shall be leased hereunder unless it shall first be made to appear, by a statement or plat filed by the Isthmian Canal Commission with the collector of revenues for the Canal Zone, that it is not contemplated to use such lands in the work of canal construction or to set the same aside as a town site; and all leases shall be made subject to the provision that if at any time it shall become necessary, notwithstanding, for the United States to occupy or use any portion of the leased lands, it shall have the right to do so without further compensation to the lessee than for the reasonable value of the necessary improvements made upon said tracts by the lessee, the same to be determined by the courts of the Canal Zone.

SEC. 3. That all leases of lands hereunder shall reserve to the United States all mineral, oil, and gas rights in the lands leased.

SEC. 4. That the President may, in his discretion, require a land survey to be made of the Canal Zone.

SEC. 5. That the powers conferred upon the President under this Act may be exercised by him through the Isthmian Canal Commission or in such other manner as he may designate.

Approved, February 27, 1909.

[Extract from an act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and ten, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, nineteen hundred and ten, namely:*

\* \* \* \* \*

#### THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President in accordance with an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two, and Acts amendatory thereof or supplementary thereto:

First. For salaries of officers and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States, one hundred and fifty thousand dollars: *Provided*, That not more than five thousand dollars of this appropriation shall be paid as compensation to the secretary of the commission.

Second. For incidental expenses, including rents, cable and telegraph service, supplies, stationery and printing, and actual necessary traveling expenses in the United States (including rent of the Panama Canal building in the District of Columbia, seven thousand five hundred dollars, text-books and books of reference, one thousand dollars, and additional compensation to the Auditor for the War Department for extra services in auditing accounts of the Isthmian Canal, one thousand dollars), seventy-five thousand dollars.

Third. For pay of members of the commission and officers and employees on the Isthmus other than skilled and unskilled labor, including civil engineers, superintendents, instrumentmen, transitmen, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, quartermasters, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, wagon masters, watchmen and stewards, including those temporarily detailed for duty away from the Isthmus, in the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, and expenses incident to conducting hearings and examining estimates for appropriations on the Isthmus, three million eight hundred and seventy-one thousand dollars.

Fourth. For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths, and other artisans, and their helpers, janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, twelve million dollars.

Fifth. For purchase and delivery of material, supplies and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the commission deems necessary to best promote the construction of the Isthmian Canal, for the departments of construction and engineering, quartermaster, subsistence, disbursements and examination of accounts, ten million five hundred and seventeen thousand dollars.

Sixth. To continue the equipment and construction of the Panama Railroad, to be disbursed directly under the Isthmian Canal Commission, seven hundred thousand dollars; no part of said sum shall be expended until the obligation of the Panama Railroad Company for the full amount thereof, and drawing four per centum interest, payable to the United States, shall have been delivered to the Secretary of the Treasury of the United States, and by him accepted.

Seventh. For miscellaneous expenditures, cable and telegraph service, stationery and printing, local railway transportation, special trains, including pay-train service;

transportation of currency to the Isthmus, recruiting and transporting laborers, transporting employees from the United States, repatriating laborers and employees, actual necessary traveling expenses while on the Isthmus on official business; and all other incidental and contingent expenses not otherwise provided for, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, and labor, quarters and subsistence, one million dollars.

Eighth. For pay of the member of the Commission in charge, of officers and employees other than skilled and unskilled labor, including foremen, subforemen, watchmen, messengers, and storekeepers, of the department of civil administration, including those necessarily and temporarily detailed for duty away from the Isthmus, four hundred and seventy thousand dollars.

Ninth. For skilled and unskilled labor for the department of civil administration, twenty thousand dollars.

Tenth. For material, supplies, equipment, construction and repairs of buildings, and contingent expenses of the Department of civil administration, one hundred and forty thousand dollars.

Eleventh. For pay of the member of the commission in charge, of officers and employees other than skilled and unskilled labor, including hospital dispensers, internes, nurses, attendants, messengers, office boys, foremen, subforemen, watchmen, and stewards, of the department of sanitation on the Isthmus, including those temporarily detailed for duty away from the Isthmus, seven hundred and twenty-five thousand dollars.

Twelfth. For skilled and unskilled labor of every grade and kind, for the department of sanitation on the Isthmus, four hundred and fifty thousand dollars.

Thirteenth. For material, supplies, equipment, construction and repairs of buildings, and contingent expenses of the department of sanitation on the Isthmus, seven hundred and forty thousand dollars.

Fourteenth. For the payment of the cost of relocating the Panama Railroad, including salaries, wages, cost of material, supplies, and all other expenses incident thereto, one million nine hundred and eighty thousand dollars.

For salaries, wages, cost of material, supplies, and all other expenses incident to continuing the extension, grading, and paving of streets, building sewers, and extending water mains in the cities of Panama and Colon, eight hundred thousand dollars.

In all, thirty-three million six hundred and thirty-eight thousand dollars, the same to be available until expended: *Provided*, That all expenditures from the appropriation herein and hereinafter made for the Isthmian Canal shall be paid from, or reimbursed to the Treasury of the United States out of, the proceeds of the sale of bonds authorized in section eight of the said Act approved June twenty-eighth, nineteen hundred and two.

Ten per centum of the foregoing amounts shall be available interchangeably for expenditure on objects named; but not more than ten per centum shall be added to any one item of the appropriation: *Provided, however*, That any surplus in the appropriations for any of the above classified heads may be used for expenditure under any of the classified appropriations for the department of construction and engineering.

No part of the foregoing appropriations for the Isthmian Canal shall be applied to the payment of allowances for longevity service or layover days other than such as may have accumulated under existing orders of the commission, prior to July first, nineteen hundred and nine.

SEC. 2. The foregoing appropriations shall be available to reimburse the Panama Railroad Company for marine losses, or for losses due to destruction or damage to its plant, equipment, or commissary supplies by fire: *Provided, however*, That the Panama Railroad Company shall carry no insurance against loss from causes covered by this appropriation.

SEC. 3. All funds hereafter collected by the government of the Canal Zone from rentals of public lands and buildings in the Canal Zone and the cities of Panama and Colon, and from the zone postal service, and from court fees and fines, and collected or raised by taxation in whatever form under the laws of the government of the Canal Zone, are hereby appropriated until and including June thirtieth, nineteen hundred and ten, as follows: The revenues derived from the postal service to the maintenance of that service; the remaining revenues, after setting aside a miscellaneous and contingent fund of ten thousand dollars, to the maintenance of the public-school system in the zone; to the construction and maintenance of public improvements within the zone; to the maintenance of the administrative districts; to the maintenance of Canal Zone charity patients in the hospitals of the Isthmian Canal Commission, and to the maintenance of administrative district prisoners. A detailed and classified statement of all receipts and expenditures without the duplication of items under this paragraph

shall be submitted to Congress after the close of the fiscal year nineteen hundred and ten.

SEC. 4. All funds realized during the fiscal year nineteen hundred and ten by the Isthmian Canal Commission from the performance of services by the commission, or from rentals, or from the sale of materials and supplies under the custody and control of the commission, are hereby reappropriated for expenditure under any of the foregoing classified appropriations for the department of construction and engineering, and a full and separate report in detail of all transactions hereunder shall be made to Congress.

SEC. 6. That all sums appropriated by this Act for salaries of officers and employees of the Government shall be in full for such salaries for the fiscal year nineteen hundred and ten, and all laws or parts of laws in conflict with the provisions of this Act be, and the same are hereby, repealed.

SEC. 8. In case of the sickness or unavoidable absence of any disbursing clerk or disbursing agent of any executive department, independent bureau, or office, in Washington, District of Columbia, he may, with the approval of the head of the department, independent bureau, or office, in which said disbursing clerk or agent is employed, authorize the clerk of highest grade employed therein to act in his place, and to discharge all the duties by law or regulations of such disbursing clerk or agent. The official bond given by the principal of the office shall be held to cover and apply to the acts of the person appointed to act in his place in such cases. Such acting officer shall, moreover, for the time being, be subject to all the liabilities and penalties prescribed by law for the official misconduct in like cases, of the disbursing clerk or disbursing agent, respectively, for whom he acts, and such acting officer shall be required by the head of the department, independent bureau, or office, to give bond to and in such sum as the disbursing clerk or disbursing agent may require.

Approved, March 4, 1909.

[Ex. ract from an act making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, nineteen hundred and nine, and for prior years, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply deficiencies in the appropriations for the fiscal year nineteen hundred and nine, and for prior years, and for other objects hereinafter stated, namely:

#### THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President in accordance with an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two:

For pay of members of the commission and officers and employees on the Isthmus other than skilled and unskilled labor, including civil engineers, superintendents, instrumentmen, transitmen, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, supervisors, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, watchmen, wagon masters, stewards, hospital dispensers, internes, nurses and attendants, including those necessarily and temporarily detailed for duty away from the Isthmus for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence, and expenses incident to conducting hearings and examining estimates for appropriations on the Isthmus, six hundred thousand dollars.

For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths, and other artisans, and their helpers, janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence, two million four hundred and fifty-eight thousand dollars.

For purchase and delivery of material, supplies, and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the

commission deems necessary to best promote the construction of the Isthmian Canal, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence, two million four hundred thousand dollars.

Authority is hereby granted for the payment of salaries and wages accrued or hereafter earned of retired army and navy officers and enlisted men now in the employment of the Isthmian Canal Commission, in addition to their retired pay, where their compensation under such employment does not exceed two thousand five hundred dollars per annum.

In all for the Isthmian Canal, five million four hundred and fifty-eight thousand dollars.

\* \* \* \* \*  
Approved, March 4, 1909.

[Extract from an act making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, nineteen hundred and nine, and for prior years, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply deficiencies in the appropriations for the fiscal year nineteen hundred and nine, and for prior years, and for other objects hereinafter stated, namely:

\* \* \* \* \*

DEPARTMENT OF STATE.

\* \* \* \* \*

For the payment of the annual installments for the calendar years nineteen hundred and eight and nineteen hundred and nine, of two hundred and fifty thousand dollars each, under the assignment and transfer made by the Republic of Panama to the Republic of Colombia, in manner and form as contained in the treaty between the Republic of Colombia and the Republic of Panama of January ninth, nineteen hundred and nine, the recognition of which assignment and acceptance of notice thereof are given by the United States in Article V of the treaty between the United States and the Republic of Colombia concluded January ninth, nineteen hundred and nine, five hundred thousand dollars.

\* \* \* \* \*

Approved, March 4, 1909.

[Extracts from an act to provide revenue, equalize duties, and encourage the industries of the United States, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:*

\* \* \* \* \*

SEC. 39. That the Secretary of the Treasury is hereby authorized to borrow on the credit of the United States from time to time, as the proceeds may be required to defray expenditures on account of the Panama Canal and to reimburse the Treasury for such expenditures already made and not covered by previous issues of bonds, the sum of two hundred and ninety million five hundred and sixty-nine thousand dollars (which sum together with the eighty-four million six hundred and thirty-one thousand nine hundred dollars already borrowed upon issues of two per cent bonds under section eight of the act of June twenty-eight, nineteen hundred and two, equals the estimate of the Isthmian Canal Commission to cover the entire cost of the Canal from its inception to its completion), and to prepare and issue therefor coupon or registered bonds of the United States in such form as he may prescribe, and in denominations of one hundred dollars, five hundred dollars, and one thousand dollars, payable fifty years from the date of issue, and bearing interest payable quarterly in gold coin at a rate not exceeding three per centum per annum; and the bonds herein authorized shall be exempt from all taxes or duties of the United States, as well as from taxation in any form by or under state, municipal, or local authority: *Provided,* That said bonds may be disposed of by the Secretary of the Treasury at not less than par, under such regulations as he may prescribe, giving to all citizens of the United States an equal opportunity to subscribe therefor, but no commissions shall be allowed or paid thereon; and a sum not exceeding one-tenth of one per centum of the amount of the bonds herein authorized is hereby appropriated, out of any

money in the Treasury not otherwise appropriated, to pay the expenses of preparing, advertising, and issuing the same; and the authority contained in section eight of the act of June twenty-eighth, nineteen hundred and two, for the issue of bonds bearing interest at two per centum per annum, is hereby repealed.

\* \* \* \* \*

Approved, August 5, 1909.

[Extract from an act making appropriations to supply urgent deficiencies in appropriations for the fiscal year nineteen hundred and nine, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:*

\* \* \* \* \*

Until otherwise provided by law no bond shall be accepted from any surety or bonding company for any officer or employee of the United States which shall cost more than thirty-five per centum in excess of the rate of premium charged for a like bond during the calendar year nineteen hundred and eight: *Provided*, That hereafter the United States shall not pay any part of the premium or other cost of furnishing a bond required by law or otherwise of any officer or employee of the United States.

That a joint commission consisting of three Senators, to be appointed by the President of the Senate, and three Members of the House of Representatives, to be appointed by the Speaker of the House of Representatives, shall inquire into the rates of premium heretofore and now being charged as well as those proposed to be charged by surety or bonding companies for bonds of officers or employees of the United States and report to Congress by bill or otherwise at its next session what regulation, if any, should be exercised under law or otherwise over the same; for the expenses of said commission, including all necessary expert, clerical, and other personal services, there is appropriated the sum of ten thousand dollars, which expenses shall be paid upon vouchers approved jointly by the chairman of said commission.

#### THE ISTHMIAN CANAL.

The President is hereby authorized to cause to be entered into such contract or contracts, not to exceed the amount of the bond issue authorized in the act entitled "An act to provide revenue, equalize duties, and encourage the industries of the United States, and for other purposes," enacted during the first session of the Sixty-first Congress, and acts supplementary thereto, as may be deemed necessary for the proper excavation, construction, and completion of such canal and harbors, to be paid for as appropriations may from time to time be made by law.

\* \* \* \* \*

Approved, August 5, 1909.

[Extract from an act making appropriations to supply urgent deficiencies in appropriations for the fiscal year nineteen hundred and ten, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the following sums be, and are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply urgent deficiencies in appropriations for the fiscal year nineteen hundred and ten, and for other purposes, namely:

#### ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President, in accordance with an act entitled "An act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two, and acts amendatory thereof or supplementary thereto:

For pay of officers and employees, Canal Zone, Isthmian Canal: For pay of the member of the commission in charge, of officers and employees, other than skilled and unskilled labor, including foremen, subforemen, watchmen, messengers, and storekeepers, of the department of civil administration, including those necessarily and temporarily detailed for duty away from the Isthmus, seventy-six thousand dollars.

\* \* \* \* \*

Approved, February 25, 1910.

An Act To amend an Act entitled "An act relating to the liability of common carriers by railroad to their employees in certain cases," approved April twenty-second, nineteen hundred and eight.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That an act entitled "An act relating to the liability of common carriers by railroad to their employees in certain cases," approved April twenty-second, nineteen hundred and eight, be amended in section six so that said section shall read:

"SEC. 6. That no action shall be maintained under this act unless commenced within two years from the day the cause of action accrued.

"Under this act an action may be brought in a circuit court of the United States, in the district of the residence of the defendant, or in which the cause of action arose, or in which the defendant shall be doing business at the time of commencing such action. The jurisdiction of the courts of the United States under this act shall be concurrent with that of the courts of the several States, and no case arising under this act and brought in any state court of competent jurisdiction shall be removed to any court of the United States."

SEC. 2. That said act be further amended by adding the following section as section nine of said act:

"SEC. 9. That any right of action given by this act to a person suffering injury shall survive to his or her personal representative, for the benefit of the surviving widow or husband and children of such employee, and, if none, then of such employee's parents; and, if none, then of the next of kin dependent upon such employee, but in such cases there shall be only one recovery for the same injury."

Approved, April 5, 1910.

[Extract from an act making appropriations for the diplomatic and consular service for the fiscal year ending June thirtieth, nineteen hundred and eleven.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums be, and they are hereby, severally appropriated, in full compensation for the diplomatic and consular service for the fiscal year ending June thirtieth, nineteen hundred and eleven, out of any money in the Treasury not otherwise appropriated, for the objects hereinafter expressed, namely:

\* \* \* \* \*

ANNUAL PAYMENT TO COLOMBIA UNDER TREATIES.

For the payment of the annual installment for the calendar year nineteen hundred and ten, under the assignment and transfer made by the Republic of Panama to the Republic of Colombia, in manner and form as contained in the treaty between the Republic of Colombia and the Republic of Panama of January ninth, nineteen hundred and nine, the recognition of which assignment and acceptance of notice thereof are given by the United States in Article V of the treaty between the United States and the Republic of Colombia concluded January ninth, nineteen hundred and nine, two hundred and fifty thousand dollars.

\* \* \* \* \*

Approved, May 6, 1910.

An Act For the relief of earthquake sufferers in Costa Rica.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the President of the United States is authorized to use and distribute among the suffering and destitute people of Costa Rica such tents, blankets, and other necessary articles belonging to the stores of the military establishment, the naval establishment, and the Isthmian Canal Commission, as may be required for the purpose of succoring the people who are in peril in Costa Rica in consequence of the recent earthquake.

Approved, May 13, 1910.

[Extract from an act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and eleven, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, nineteen hundred and eleven, namely:

\* \* \* \* \*



## THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President, in accordance with an act entitled "An act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two, and acts amendatory thereof or supplementary thereto.

First. For salaries of officers and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States, one hundred and forty thousand dollars.

Second. For incidental expenses, including rents, cable and telegraph service, supplies, stationery and printing, and actual necessary traveling expenses in the United States (including rent of the Panama Canal building in the District of Columbia, seven thousand five hundred dollars, text-books and books of reference, one thousand dollars, and additional compensation to the Auditor for the War Department for extra services in auditing accounts of the Isthmian Canal, one thousand dollars), seventy thousand dollars.

Third. For pay of members of the commission and officers and employees on the Isthmus, other than skilled and unskilled labor, including civil engineers, superintendents, instrumentmen, transitmen, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, quartermasters, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, wagon masters, watchmen and stewards, including those temporarily detailed for duty away from the Isthmus, in the departments of construction and engineering, quartermasters', subsistence, disbursements and examination of accounts, three million nine hundred thousand dollars: *Provided*, That not more than five thousand dollars of this appropriation shall be paid as compensation to the secretary of the commission.

Fourth. For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths and other artisans, and their helpers; janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, quartermaster's disbursements and examination of accounts, thirteen million five hundred thousand dollars.

Fifth. For purchase and delivery of material, supplies and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the commission deems necessary to best promote the construction of the Isthmian Canal, for the departments of construction and engineering, quartermaster's subsistence, disbursements and examination of accounts, fifteen million dollars.

Sixth. For miscellaneous expenditures, cable and telegraph service, stationery and printing, local railway transportation, special trains, including pay-train service; transportation of currency to the Isthmus, recruiting and transporting laborers, transporting employees from the United States, repatriating laborers and employees, actual necessary traveling expenses while on the Isthmus on official business; expenses incident to conducting hearings and examining estimates for appropriations on the Isthmus and all other incidental and contingent expenses not otherwise provided for, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, nine hundred thousand dollars.

Seventh. For pay of the member of the commission in charge, of officers and employees, other than skilled and unskilled labor, including foremen, subforemen, watchmen, messengers, and storekeepers, of the department of civil administration, including those necessarily and temporarily detailed for duty away from the Isthmus, six hundred thousand dollars.

Eighth. For skilled and unskilled labor for the department of civil administration, twenty thousand dollars.

Ninth. For material, supplies, equipment, construction and repairs of buildings, and contingent expenses of the department of civil administration, one hundred thousand dollars.

Tenth. For survey of lands in the Canal Zone, seventy-five thousand dollars.

Eleventh. For pay of the member of the commission in charge, of officers and employees other than skilled and unskilled labor, including hospital dispensers, internes, nurses, attendants, messengers, office boys, foremen, and subforemen, watchmen, and stewards, of the department of sanitation on the Isthmus, including those temporarily detailed for duty away from the Isthmus, six hundred thousand dollars.

Twelfth. For skilled and unskilled labor of every grade and kind, for the department of sanitation on the Isthmus, two hundred thousand dollars.

Thirteenth. For material, supplies, equipment, construction and repairs of buildings, and contingent expenses of the department of sanitation on the Isthmus, seven hundred and fifty thousand dollars.

Fourteenth. For the payment of the cost of relocating the Panama Railroad, including salaries, wages, material, and supplies, and all other expenses incident thereto, two million dollars.

In all, thirty-seven million eight hundred and fifty-five thousand dollars, the same to be available until expended: *Provided*, That all expenditures from the appropriations herein and hereafter made for the Isthmian Canal shall be paid from, or reimbursed to the Treasury of the United States out of the proceeds of the sale of bonds authorized in section eight of the said act approved June twenty-eighth, nineteen hundred and two, and section thirty-nine of the tariff act approved August fifth, nineteen hundred and nine.

Ten per centum of the foregoing amounts shall be available interchangeably for expenditure on objects named; but not more than ten per centum shall be added to any one item of the appropriation.

No part of the foregoing appropriations for the Isthmian Canal shall be applied to the payment of allowances for longevity service, or layover days other than such as may have accumulated under existing orders of the commission, prior to July first, nineteen hundred and nine.

Sec. 2. The foregoing appropriations shall be available to reimburse the Panama Railroad Company for marine losses and for losses due to destruction of or damage to its plant, equipment, or commissary supplies by fire: *Provided*, That the Panama Railroad Company shall carry no insurance against loss from causes covered by this appropriation: *Provided, further*, That hereafter payment by the Panama Railroad Company to the United States, in accordance with the treaty with Panama, of the annual subsidy of two hundred and fifty thousand dollars, as provided by the concession granted by the United States of Colombia, shall not be required.

Sec. 3. All funds collected by the government of the Canal Zone from rentals of public lands and buildings in the Canal Zone and the cities of Panama and Colon, and from the zone postal service, and from court fees and fines, and collected or raised by taxation in whatever form under the laws of the government of the Canal Zone, are hereby appropriated until and including June thirtieth, nineteen hundred and eleven, as follows: The revenues derived from the postal service to the maintenance of that service; the remaining revenues, after setting aside a miscellaneous and contingent fund of ten thousand dollars, to the maintenance of the public-school system in the zone; to the construction and maintenance of public improvements within the zone; to the maintenance of the administrative districts; to the maintenance of Canal Zone charity patients in the hospitals of the Isthmian Canal Commission, and to the maintenance of administrative district prisoners. A detailed and classified statement of all receipts and expenditures without the duplication of items under this paragraph, shall be submitted to Congress after the close of the fiscal year nineteen hundred and eleven.

Sec. 4. All funds realized during the fiscal year nineteen hundred and eleven by the Isthmian Canal Commission from the performance of services by the commission, or from rentals, or from the sale of materials and supplies under the custody or control of the commission, are appropriated for expenditure under any of the foregoing classified appropriations for the department of construction and engineering, and a full and separate report in detail of all transactions hereunder shall be made to Congress.

Sec. 5. Hereafter there shall be submitted under each item of appropriation, proposed in the annual estimates for construction of the Isthmian Canal, notes giving in parallel columns information which will show the number, by grade or classes, of officers, employees, and skilled and unskilled laborers proposed to be paid under each of said appropriations for the ensuing fiscal year and those being paid at the close of the fiscal year next preceding the period when said estimates are prepared and submitted; also, in connection with each item for material and miscellaneous purposes other than salaries or pay for personal services, the amounts actually expended or obligated for like purposes during the entire fiscal year next preceding the preparation and submission of said estimates.

Sec. 6. Hereafter the statement of the proceeds of all sales of old material, condemned stores, supplies, or other public property of any kind shall be submitted to Congress at the beginning of each regular session thereof as a separate communication and shall not hereafter be included in the annual Book of Estimates.

\* \* \* \* \*

Sec. 10. That all sums appropriated by this Act for salaries of officers and employees of the Government shall be in full for such salaries for the fiscal year nineteen hundred and eleven, and all laws or parts of laws in conflict with the provisions of this Act be, and the same are hereby, repealed.

Approved, June 25, 1910.

10307°—11—37

Joint Resolution Authorizing the President to invite foreign countries to participate in the Panama-Pacific International Exposition in nineteen hundred and fifteen, at San Francisco, California.

*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled,* That whenever it shall be shown to the satisfaction of the President of the United States that a suitable site has been selected, and that the sum of not less than fifteen million dollars will be available to enable the Panama-Pacific International Exposition Company, a corporation organized and existing under and by virtue of the laws of the State of California, for the purpose of inaugurating, carrying forward, and holding an exposition at the city and county of San Francisco, California, on or about the first day of January, nineteen hundred and fifteen, to celebrate the completion and opening of the Panama Canal, and also the four hundredth anniversary of the discovery of the Pacific Ocean, the President of the United States be, and he hereby is, authorized and respectfully requested, by proclamation or in such manner as he may deem proper, to invite all foreign countries and nations to such proposed exposition, with a request that they participate therein.

Approved, February 15, 1911.

An Act To restrain the Secretary of the Treasury from receiving bonds issued to provide money for the building of the Panama Canal as security for the issue of circulating notes to national banks, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of the Treasury be, and he is hereby, authorized to insert in the bonds to be issued by him under section thirty-nine of an Act entitled "An Act to provide revenue, equalize duties, and encourage the industries of the United States, and for other purposes," approved August fifth, nineteen hundred and nine, a provision that such bonds shall not be receivable by the Treasurer of the United States as security for the issue of circulating notes to national banks; and the bonds containing such provision shall not be receivable for that purpose.

Approved, March 2, 1911.

[Extract from an act making appropriations for the naval service for the fiscal year ending June thirtieth, nineteen hundred and twelve, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums be, and they are hereby, appropriated, to be paid out of any money in the Treasury not otherwise appropriated, for the naval service of the Government for the year ending June thirtieth, nineteen hundred and twelve, and for other purposes.

\* \* \* \* \*

By a joint resolution of Congress the President of the United States has been authorized and respectfully requested, by a proclamation or in such manner as he may deem proper, to invite all foreign countries and nations to attend and participate in an exposition at the city and county of San Francisco, California, on or about the first day of January, nineteen hundred and fifteen, to celebrate the completion and opening of the Panama Canal, and also the four hundredth anniversary of the discovery of the Pacific Ocean.

The President is further authorized and respectfully requested, in extending his invitation to the foreign nations in pursuance of the aforesaid joint resolution of Congress, to invite their representatives and their fleets to assemble at Hampton Roads, Virginia, and from thence come to the city of Washington, there to be formally welcomed by the President; and at the conclusion of the ceremonies at Washington, the President is requested to proceed to Hampton Roads and there review the assembled fleets as they start on their voyage to the city of San Francisco.

Approved, March 4, 1911.

[Extract from an act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and twelve, and for other purposes.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, nineteen hundred and twelve, namely:

\* \* \* \* \*

#### THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President, in accordance with an Act entitled "An Act to provide for

the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June twenty-eighth, nineteen hundred and two, and Acts amendatory thereof or supplementary thereto:

First. For salaries of officers and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States, one hundred and thirty thousand dollars.

Second. For incidental expenses, including rents, cable and telegraph service, supplies, stationery and printing, and actual necessary traveling expenses in the United States (including rent of the Panama Canal building in the District of Columbia, seven thousand five hundred dollars, textbooks and books of reference, one thousand dollars, and additional compensation to the Auditor for the War Department for extra services in auditing accounts of the Isthmian Canal, one thousand dollars), fifty thousand dollars.

Third. For pay of members of the commission and officers and employees on the Isthmus, other than skilled and unskilled labor, including civil engineers, superintendents, instrumentmen, transmitters, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, quartermasters, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, wagon masters, watchmen, and stewards, including those temporarily detailed for duty away from the Isthmus, in the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, three million nine hundred thousand dollars: *Provided*, That not more than five thousand dollars of this appropriation shall be paid as compensation to the secretary of the commission.

Fourth. For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths, and other artisans, and their helpers; janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, sixteen million five hundred thousand dollars.

Fifth. For purchase and delivery of material, supplies, and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the commission deems necessary to best promote the construction of the Isthmus Canal, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, nineteen million dollars.

Sixth. For miscellaneous expenditures, cable and telegraph service, stationery and printing, local railway transportation, special trains, including pay-train service; transportation of currency to the Isthmus, recruiting and transporting laborers, transporting employees from the United States, repatriating laborers and employees, actual necessary traveling expenses while on the Isthmus on official business; expenses incident to conducting hearings and examining estimates for appropriations on the Isthmus, and all other incidental and contingent expenses not otherwise provided for, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, nine hundred and fifty thousand dollars.

Seventh. For pay of the member of the commission in charge, of officers and employees, other than skilled and unskilled labor, including foremen, subforemen, watchmen, messengers, and storekeepers, of the department of civil administration, including those necessarily and temporarily detailed for duty away from the Isthmus, five hundred and fifty thousand dollars;

Eighth. For skilled and unskilled labor for the department of civil administration, twenty thousand dollars;

Ninth. For material, supplies, equipment, construction and repairs of buildings, and contingent expenses of the department of civil administration, including not exceeding five hundred dollars for law books, one hundred and ten thousand dollars;

Tenth. For pay of the member of the commission in charge, of officers and employees other than skilled and unskilled labor, including hospital dispensers, internes, nurses, attendants, messengers, office boys, foremen and subforemen, watchmen, and stewards, of the department of sanitation on the Isthmus, including those temporarily detailed for duty away from the Isthmus, six hundred thousand dollars;

Eleventh. For skilled and unskilled labor of every grade and kind, for the department of sanitation on the Isthmus, two hundred thousand dollars;

Twelfth. For material, supplies, equipment, construction and repairs of buildings, medical aid and support of the insane, and of indigent persons permanently disabled, while in the line of duty and in the employ of the Isthmian Canal Commission, from earning a livelihood, and contingent expenses of the department of sanitation on the Isthmus, eight hundred thousand dollars.

Thirteenth. For the payment of the cost of relocating the Panama Railroad, including salaries, wages, material, and supplies, and all other expenses incident thereto, two million seven hundred and fifty thousand dollars.

In all, forty-five million five hundred and sixty thousand dollars, the same to be immediately available and to continue available until expended: *Provided*, That all expenditures from the appropriations heretofore, herein, and hereafter made for the Isthmian Canal, exclusive of fortifications, shall be paid from, or reimbursed to the Treasury of the United States out of the proceeds of the sale of bonds authorized in section eight of the said Act approved June twenty-eighth, nineteen hundred and two, and section thirty-nine of the tariff Act approved August fifth, nineteen hundred and ten.<sup>1</sup>

Except in cases of emergency, or conditions arising subsequent to and unforeseen at the time of the passage of this Act, there shall not be employed at any time during the fiscal year nineteen hundred and twelve, under any of the foregoing appropriations for the Isthmian Canal, any greater number of persons than are specified in the notes submitted respectively in connection with the estimates for each of said appropriations in the annual book of estimates for said year, nor shall there be paid to any of such persons during that fiscal year any greater rate of compensation than was authorized to be paid to persons occupying the same or like positions on the first day of July, nineteen hundred and ten, and all employments made or compensation increased because of emergencies or conditions so arising shall be specifically set forth, with the reasons therefor, by the chairman of the commission in his report for the fiscal year nineteen hundred and twelve.

Ten per centum of the foregoing amounts shall be available interchangeably for expenditure on objects named; but not more than ten per centum shall be added to any one item of the appropriation.

No part of the foregoing appropriations for the Isthmian Canal shall be applied to the payment of allowances for longevity service, or lay-over days other than such as may have accumulated under existing orders of the commission, prior to July first, nineteen hundred and nine.

#### FORTIFICATIONS, ISTHMIAN CANAL.

For construction of seacoast batteries on the Canal Zone, two million dollars.

For the purchase, manufacture and test of seacoast cannon for coast defense, including their carriages, sights, implements, equipments, and the machinery necessary for the manufacture at the arsenals, to cost ultimately not to exceed one million nine hundred and sixty-six thousand dollars, one million dollars, the same to be immediately available and to continue available until expended.

SEC. 2. Hereafter the Panama Railroad Company shall carry no insurance to cover marine or fire losses, nor make any further payment on the principal or interest on notes heretofore given by it to the United States for moneys appropriated for its use.

SEC. 3. All funds collected by the government of the Canal Zone from rentals of public lands and buildings in the Canal Zone and the cities of Panama and Colon, and from the zone postal service, and from court fees and fines, and collected or raised by taxation in whatever form under the laws of the government of the Canal Zone, are hereby appropriated until and including June thirtieth, nineteen hundred and twelve, as follows: The revenues derived from the postal service to the maintenance of that service; the remaining revenues, including any balances unexpended in prior years, after setting aside a miscellaneous and contingent fund of not exceeding ten thousand dollars, to the maintenance of the public-school system in the zone; to the construction and maintenance of public improvements within the zone; to the maintenance of the administrative districts; to the maintenance of Canal Zone charity patients in the hospitals of the Isthmian Canal Commission, and to the maintenance of administrative district prisoners. A detailed and classified statement of all receipts and expenditures without the duplication of items under this paragraph shall be submitted to Congress after the close of the fiscal year nineteen hundred and twelve.

SEC. 4. All funds realized during the fiscal year nineteen hundred and twelve by the Isthmian Canal Commission from the performance of services by the commission, or from rentals, or from the sale of materials and supplies under the custody or control of the commission, are appropriated for expenditure under any of the foregoing classified appropriations for the department of construction and engineering; and a full and separate report in detail of all transactions under this section shall be made to Congress.

<sup>1</sup> Should be "nineteen hundred and nine".

That until the close of the fiscal year nineteen hundred and twelve, when any material, supplies, and equipment heretofore or hereafter purchased or acquired for the construction of the Isthmian Canal is no longer needed, or is no longer serviceable, it may be sold in such manner as the Secretary of War may direct, and without advertising in such classes of cases as may be authorized by him.

SEC. 5. That hereafter the Act granting to certain employees of the United States the right to receive from it compensation for injuries sustained in the course of their employment shall apply to all employees under the Isthmian Canal Commission, when injured in the course of their employment; and claims for compensation on account of injury or death resulting from an accident occurring hereafter shall be settled by the chairman of the Isthmian Canal Commission, who shall, as to such claims and under such regulations as he may prescribe, perform all the duties now devolving upon the Secretary of Commerce and Labor: *Provided*, That when an injury results in death, claim for compensation on account thereof shall be filed within one year after such death.

SEC. 6. Hereafter the Panama Railroad Company shall not be required to give bond, either with or without surety, in contracts which it may make to furnish services, materials, or supplies to the Army, Navy, Marine Corps, or other departments of the Government, and such contracts may be made for periods less than one year, as may be agreed on, and formal contracts in writing shall not be required unless agreed on.

SEC. 7. That all sums appropriated by this Act for salaries of officers and employees of the Government shall be in full for such salaries for the fiscal year nineteen hundred and twelve, and all laws or parts of laws in conflict with the provisions of this Act be, and the same are hereby, repealed.

Approved, March 4, 1911.



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